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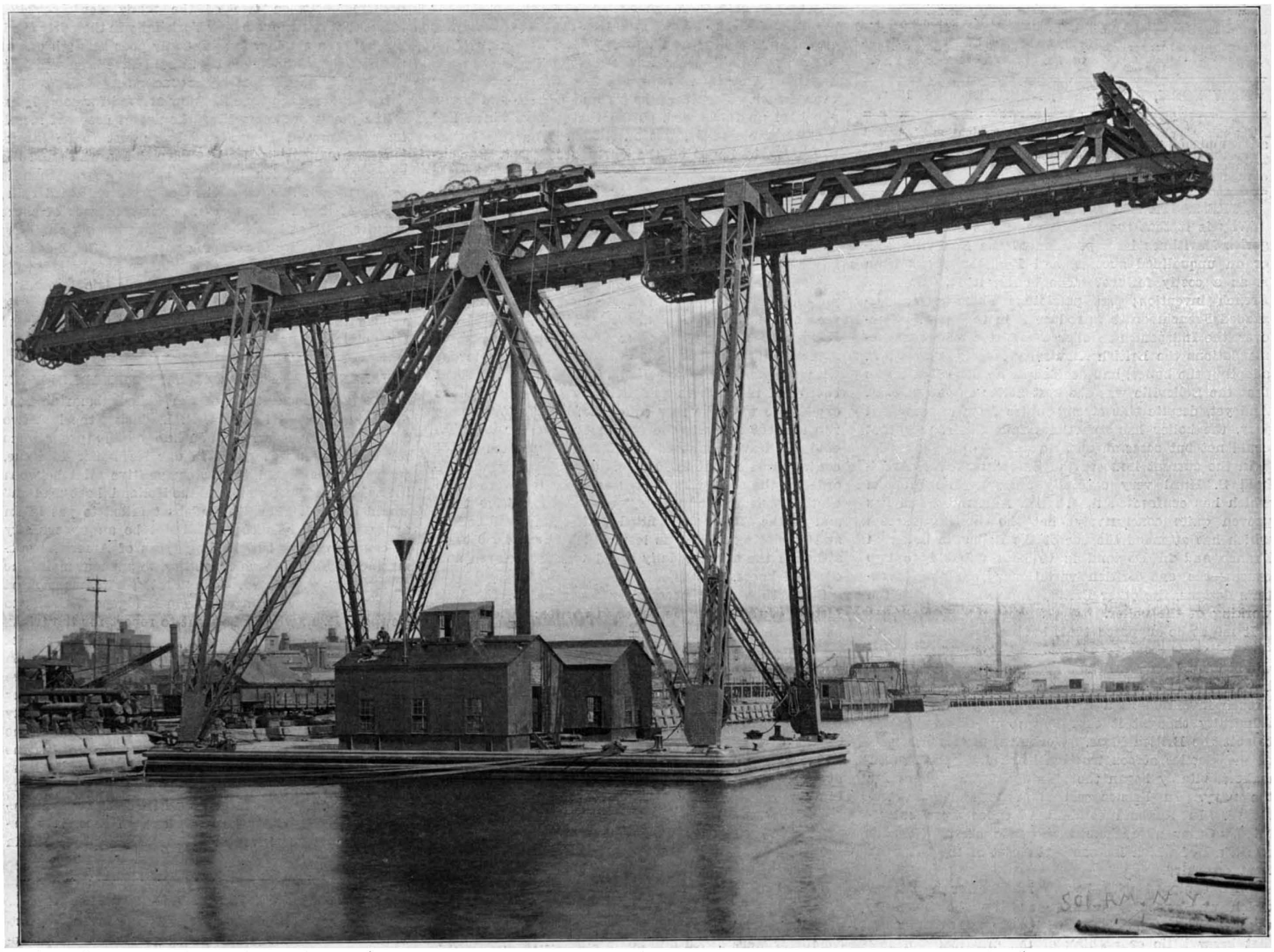

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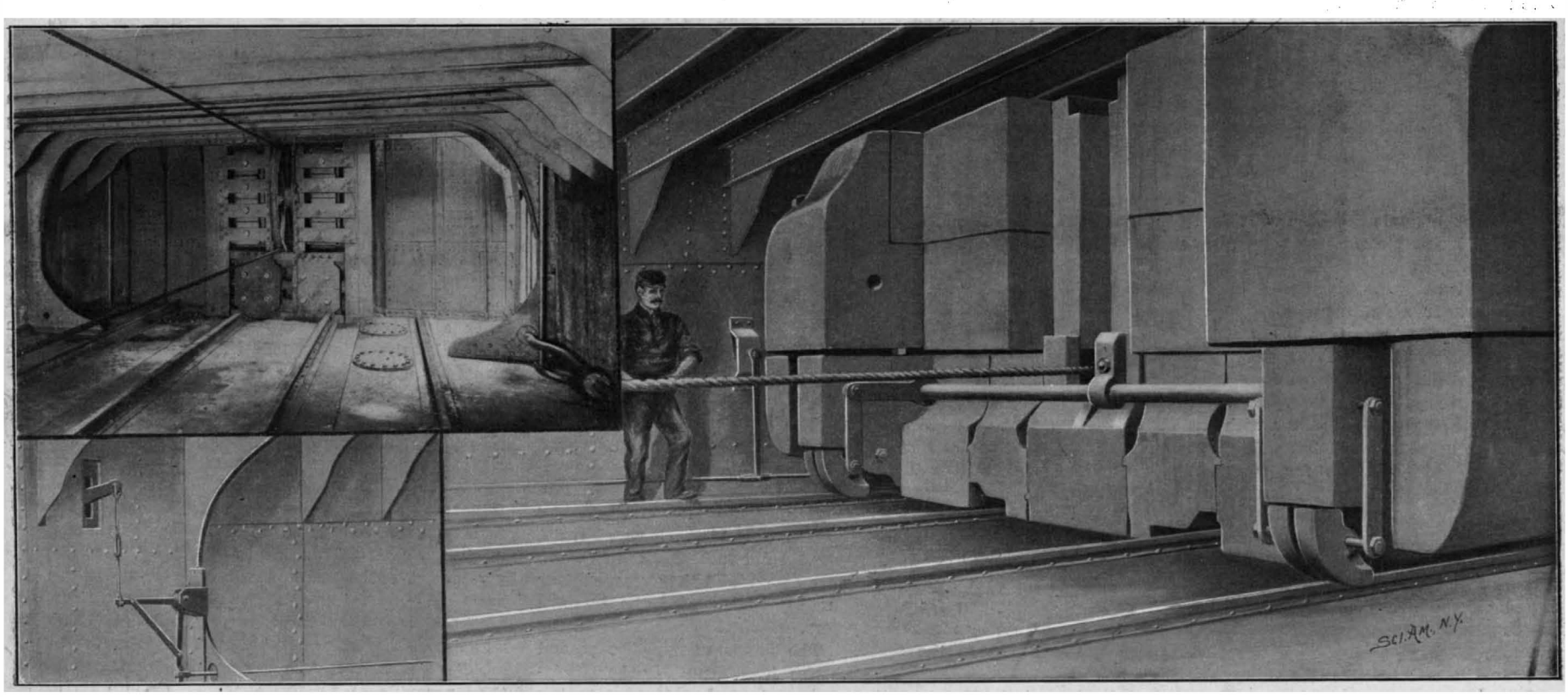
New One Hundred-Ton Floating Crane.



End View of Counterweight Compartment, and Detail of Levers for Controlling Counterweight.

Below Decks on the Pontoon, Showing the Movable 300-Ton Counterweight.

ONE-HUNDRED-TON FLOATING CRANE AT THE NAVY YARD, BROOKLYN.—[See page 386.]

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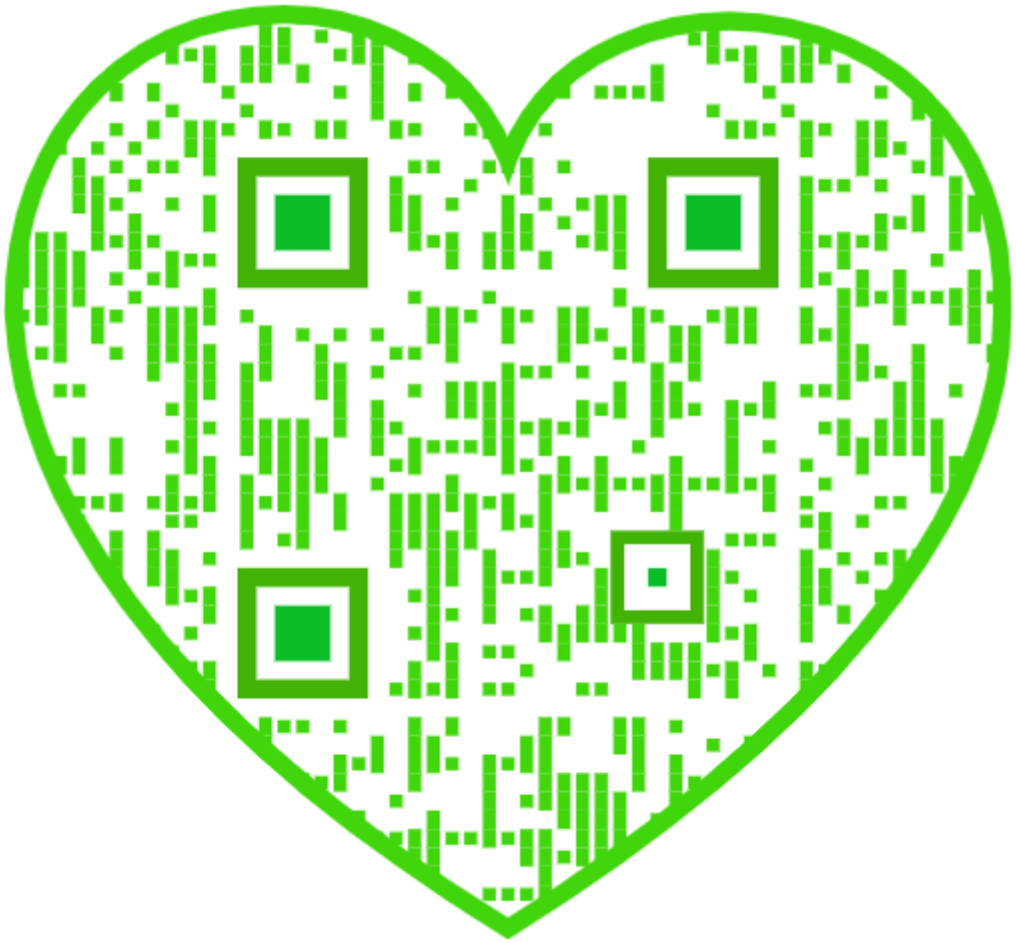

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NEW YORK, SATURDAY, NOVEMBER 28, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE TRUTH ABOUT THE BELLEVILLE BOILER.

Why is it that the French engineers of the Messageries Maritimes have pronounced the Belleville boiler an unqualified success, and Englishmen condemn it as a costly failure? The boiler, it is true, is a French invention; but patriotism alone never persuaded Frenchmen to introduce it in the navy. Moreover, the Independent Boiler Committee, whose recommendations the British Admiralty largely followed in adopting the boiler, had decided in no uncertain terms that the Belleville was the best boiler on the market. And yet, despite this strong praise from an unbiased jury, the boiler has sometimes failed in a way that could not but occasion uneasiness.

In the current issue of the SUPPLEMENT, Mr. Archibald S. Hurd very carefully analyzes the problem which has confronted the British Admiralty, and has proven quite conclusively that the varying success which has attended the use of the Belleville boiler in France and in England is to be attributed to two causes—the one British variations from the inventor's designs, the other British unfamiliarity with the working of the boiler.

It might be supposed that, having decided to adopt the Belleville boiler, the experience of the inventor would have been drawn upon by the Admiralty. Moved largely by Parliamentary objections to the use of a French invention in a British warship, however, the Admiralty thought it expedient to modify the plans to suit the British ideas. Workmen, utterly ignorant of the niceties of construction learned by the French makers, blindly began the building of the boilers for the navy. In France welded tubes had been employed. In England solid-drawn tubes were substituted. Other alterations were made of questionable merit, all of which increased the cost of the boiler at least one-third.

Ships equipped with boilers made after a pattern which was probably unsanctioned by the inventor, were placed in commission with an engine-room staff that knew little or nothing of the practical working of the new steam generator, except that it required more nursing than the Scotch boiler and that it needed more careful stoking. The older men, in particular, looked askance at the innovation. Even if they knew enough about the boiler, they were little disposed to give it a fair trial. It happens frequently enough in the British navy, not only that engineer officers are placed in charge of boilers and engines about which they are technically ill informed, but also that the number of these officers is wofully insufficient for the task assigned to them. Is it any wonder that breakdowns occurred?

The more intimate the engineer's acquaintance with the machinery which is intrusted to his care, the greater will be the efficiency of that machinery as time passes. In a fighting-ship perhaps more depends upon the man who gets up steam than upon the much-praised man behind the gun. And yet a few months ago the military prestige of Great Britain depended upon warships with men in the engine room who were anything but familiar with the boilers they were called upon to supervise.

That the chief reasons for most failures of the Belleville boilers in British ships are to be found in the uncalled-for modifications of the French type and in the lack of skill of British engineers, Mr. Hurd has shown by many a striking example. After much delay and at no small cost, the British authorities learned how to make the boiler, and trained a large number of officers and men in its use. The result was magical.

Within the last few months ships which have been fitted with the Belleville boiler have more than justified the expectations of its most ardent advocates. Of the twenty-six battleships and forty-three cruisers which took part in the recent naval maneuvers, but one vessel broke down, and that was the "Blake," fitted with Scotch and not with Belleville boilers. Twenty-one of the ships had been equipped with the French steam generator. Each of the vessels during the preliminary operations was made to cover a distance of from 2,000 to 2,500 miles. And yet in no instance were the boilers found wanting. Perhaps the most striking illustration of the efficiency of the boiler was afforded by the remarkable run of the cruiser "Good Hope" during the maneuvers. She took on coal at Portland, and steamed for the Azores at a speed of eighteen knots. There she received orders to chase one of the cruisers of the opposite side. She had slowed down to nine knots for over half an hour to communicate with the senior Admiral, Sir Arthur Wilson, but in seven minutes she was traveling through the water at nineteen knots, and in half an hour she was speeding at twenty-two and one-half knots, with still enough steam to enable her to move even faster. For three hours and a half and more, she kept up this speed. Then the quarry, which had a start of ten miles, was overtaken. The vessel then proceeded to Lagos on the Portuguese coast. She arrived in good order for the series of tactical exercises which had been planned for the combined British fleets.

Still another remarkable example is afforded by the cruiser "Spartiate," whose reputation as a ship is anything but enviable. For six years her construction had been delayed. When she was at last completed, her trials proved her a most unsatisfactory vessel. On March 17 last, she left England for Hong Kong with a relief crew for the battleship "Ocean." Although two of her engineer officers were familiar with the working of her Belleville boilers, only about twenty of the stokers and artificers had had previous experience with the new generator. Nevertheless, the run of 9,600 miles to the far East was creditably covered at an average speed of thirteen knots with a coal consumption of but 3,000 tons. The best previous records for the same trip in coal consumption were those of the cruiser "Amphitrite," which burnt 4,200 tons, and of the "Blenheim," fitted with cylindrical boilers and displacing 2,000 tons less, which burnt 4,000 tons, although the average daily speed was only eleven and one-half knots.

Some time must necessarily lapse before the true history of the Belleville boiler is written. The experience gained within recent months proves, however, that the introduction of the boiler will be attended with the same success which marked its use in the Messageries Maritimes. Too much haste has been shown in condemning a system only too imperfectly understood in England. Whether the Belleville boiler or one of its half dozen rivals will ultimately be selected by naval engineers, no one can tell. This much at least is certain—the water-tube boiler as an adjunct to a fighting-ship has come to stay.

FIREPROOF METALLIC CARS AND A PROTECTED THIRD RAIL URGENTLY NEEDED ON ELECTRIC ELEVATED AND TUNNEL RAILWAYS.

The collision which occurred on the Fifth Avenue line of the Brooklyn Elevated Railway early in the evening of November 19, by which a motorman and a conductor were killed and some half dozen passengers were seriously injured, should sound a note of warning to the management of the new Rapid Transit tunnel road, and cause the operating company to pause before equipping the road with cars that are not surely incombustible, even in the intense heat of electric arcs that generally occur when there is a collision.

In the accident referred to, an empty train was proceeding toward New York, when a fuse blew out, extinguishing the lights and bringing the train to a standstill. Whether oil danger lights were burning on the rear end of the train or not, is not definitely known; but the action of the conductor in immediately attempting to reach its rear end with a red lantern (as a result of which he lost his life) would perhaps indicate that the lights were not in place. Otherwise, it seems improbable that the motorman of the following train, which was well filled with passengers, would not have seen the lights in time to stop, as this train crashed into the empty one on a straight track and under perfectly clear weather conditions. At the same instant that the collision occurred, there was a loud explosion, and flames shot up from beneath the car at its forward end, setting it ablaze almost before the badly shaken-up and injured passengers had time to crowd back into the rear cars. Although thrown from the track, and telescoped into the two rear cars of the forward train, the head car fortunately did not fall from the elevated structure. Firemen were called, and they rescued four trainmen from the burning rear car of the forward train by means of ladders, which they put up from the street to the track. The passengers of the second train made their way back with difficulty to the Thirty-sixth Street station, in constant danger of stepping on the live third rail. The collision occurred alongside of Greenwood Cemetery, and two passengers and a guard jumped to the ground to escape from the burning train. The inefficiency of the railway company in case of accident is shown by the fact that it was an hour and a half before a rescue train arrived. The motorman was found dead at his post, his body being badly charred; and the conductor of the forward train was found in the rear car, lantern in hand.

The accident is a forcible reminder of the dangers of third rail electric traction as carried on to-day in many of our leading cities; and it has again demonstrated that, despite signals, automatic devices, and all precautions, the failure of one individual to perform his duty, either from neglect or accident, may precipitate a disaster of the most terrible kind. When one thinks of the lives that would have been lost had the collision occurred between two of the many densely-packed trains that return from New York daily in the early evening hours, a shudder involuntarily goes through one at the thought of the havoc that would have been wrought, and that is now constantly menacing.

It is evident the time has now arrived for some legislative enactment compelling the use of fireproof metallic cars, proved by an actual fire test to be incombustible, and substantially constructed to withstand the shock of a collision in a far greater degree than is ordinarily possible, as well as of protected third rails, which, if they will not cease arcing in case of short circuits, will, at least, be incapable of setting anything afire, or of giving to escaping passengers death-dealing shocks. Such a law could doubtless be applied with benefit to the rolling stock of all electric street car lines, but in the case of elevated and tunnel roads, it seems an absolute necessity for the proper protection of the public.

GOVERNMENT TESTS OF THE LAKE SUBMARINE BOAT.

The government tests of the Lake submarine boat are being held at Newport, R. I., during the last two weeks in November. An outline of the programme for these tests was given in our November 14 issue, where it was stated that a competitive trial between the Lake boat "Protector" and the Holland boat "Fulton" would be held. The Holland boat failed to put in an appearance, and so there will not be an opportunity of comparing the two leading types of American submarine boats as to their ability to maneuver in the open sea, as was hoped. The "Protector" demonstrated her seaworthiness in a run from Bridgeport, Conn., to Newport, R. I., where she went to report for the trials, as she covered the distance at an average speed of nearly 7 miles an hour, with a sloop and a launch in tow, and during rough weather. We are not aware that any boat of the Holland, or diving, type has ever been run outside of land-locked waters, and incapability of negotiating heavy seas may therefore be one of the reasons for the non-appearance of the "Fulton." The Lake boat is an improvement in this respect at least over the half-dozen odd submarines now owned by our government, and it is to be hoped that the test will result in showing other improvements of secondary importance that the inventor claims are incorporated in the "Protector."

PHOTOGRAPHIC PRINTS WITHOUT LIGHT.

"Katatypes" is the name given by the inventors, Ostwald and Gros, of Leipzig, to prints made from photographic negatives without the aid of light. The process is based on the properties of peroxide of hydrogen and on the formerly mysterious chemical phenomenon which is known as katalysis. By katalysis is meant the production of a chemical reaction by means of a substance which itself undergoes no chemical change. The first known instance is the conversion of starch into sugar by treatment with acids, the latter being found unchanged, and undiminished in quantity in the final mixture.

Another case is the explosion of mixed hydrogen and oxygen in the presence of finely divided platinum.

Recent experiments on the speed of chemical reactions have thrown a little light into the darkness of this mysterious katalysis, and it is now believed that all such reactions would take place of themselves but with almost infinite slowness, and that the function of the katalyzer is to make the reaction rapid enough to be perceptible to our senses. Possibly, it overcomes some unknown resistance to the reaction, thus acting as a sort of chemical unguent. Now most of the chemical changes which are apparently wrought by light are of this sort. They take place, though slowly, in the dark. Every photographer knows this from experience. His bichromated paper becomes useless in a few days, his plates in a few months or years.

The function of light in photography, then, is simply that of an accelerator, a katalyzer, and it may be replaced by other katalyzers. Now there are few better katalyzers than the layer of finely divided silver which forms a photographic negative picture, and there are few substances more susceptible of katalytic action than peroxide of hydrogen, which, despite its excess of oxygen, and its resultant tendency to split up into oxygen and water, is entirely permanent under normal conditions.

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This is the theory of the katatype. Its practice is as follows:

The negative is flowed with an ethereal solution of peroxide of hydrogen. The peroxide is instantly decomposed more or less completely wherever it comes in contact with the silver film, and the evaporation of the resulting water leaves on the plate an invisible picture in unaltered peroxide which is densest where the negative is least dense, and is therefore a positive. As peroxide of hydrogen is both an oxidizer and a deoxidizer and lends itself to many chemical reactions, the subsequent processes are of great variety. The simplest consists in transferring the picture by slight pressure to gelatine-coated paper which is flowed with ferrous sulphate, washed, and treated with gallic acid, the result being a dark-violet and very permanent picture—in fact, a picture in writing ink. Other tones may be produced by using various solutions in place of gallic acid. In another process the ferrous sulphate is replaced by a solution of manganese, the result being a picture in peroxide of manganese which may be toned in various ways. Or the invisible picture may be transferred from the negative to gum or gelatine pigment papers, *not* sensitized with bichromate, and developed in ferrous solutions.

The production of ferric salts in proportion to the density of peroxide makes the shadows insoluble and the lights are washed away with warm water in the usual way.

A similar process is employed for the production of gelatine plates for printing in lithographic ink.

The advantages claimed for the katatype are that it makes the photographer independent of the uncertainty of natural, and the inconvenience and expense of artificial light, and that it dispenses with all sensitized and therefore perishable papers.

The result is the same whether the plate is flowed in bright sunlight or in absolute darkness.

NAMING THE VESSELS OF THE NAVY.

BY LIEUT. ARTHUR BAINBRIDGE HOFF, U. S. N.

To the man-o'-war's man there is nothing about a ship so pregnant of meaning as her name. If the name is new, it is bright with hope; if old, proud with tradition. It looks as if we must soon return to our old service names, each one comprising in its less-than-a-dozen letters a bit of history fraught with courage, bravery, peril, fortitude, and right. The "Constitution," "Bonhomme Richard," "Hartford"—these mean a lot to the men that go to sea in the white ships with the long pennant.

Our law requiring us to give the names of States to ships of the first rate was a very wise law. When it was passed by Congress, the navy needed to be popularized, and since that time we have risen from nowhere on the list of sea powers to fifth in rank. But now of the names of States but five remain to be used, Utah, Delaware, North Carolina, South Carolina, and North Dakota. Consequently, the opportunity is now presented of reverting to the old names. Everybody seems to want them; and everybody knows them. In foreign navies the names of old ships are always perpetuated. In the British navy to-day we find some of the names of vessels that drove back the Armada. Think of it! And yet our own names are no whit less glorious. For our larger ships we could take the old frigate names, "Bonhomme Richard," "Constitution," "Constellation," "United States," "Essex." These bore the pennants of John Paul Jones, Hull, Truxtun, Decatur, Porter. They should be memorialized in the steel and steam navy of to-day. Why not? And just as well-known heroes flew the flag on board sloops and smaller craft. Now which is better—to keep our old names in the service, or keep on naming our cruisers and smaller craft after towns and cities? Why not name at least half of them after our old friends of 1776 and 1812? These names, for instance, should never be missing from our list: "Andrea Doria," "Alfred," "Ranger," "Raleigh," "Saratoga," "Alliance," "Enterprise," "Boston," "Hornet," "Wasp," "Peacock," "Niagara," "Eagle," "Ticonderoga." All of these and all the frigate names are the names of victors in sea fights. Then there are old honored names in the navy such as "President," "Hancock," "George Washington," "Congress," "Lexington," "Potomac," "John Adams," etc.

Names which stir up the most inspiring memories are those of vessels captured from the enemy or destroyed in open battle. These form an actual record of our past success.

Look at the big English ships with French names—the "Impérieuse," "Achille," "Pomone," "Barfleur," "Sans Pareil"—every one a Frenchman captured. And they even have our own "Essex" and "President" on their list; just as we still have on our list the "Alert," "Detroit" and "Boxer," taken from them. Now, what a glorious idea this is! Think of five battleships with the British names (frigates) "Serapis," "Guerriere," "Macedonian," "Java," "Conflance," and the French "Insurgente;" in addition to the lately acquired names in Montojo's and Cervera's squadrons. These should be applied to our larger ships. For our smaller ships we could be supplied from our long list of other captures. Those taken in hard-fought fight should come first, however. The chief of these are "Racehorse," "Drake," "Countess of Scarborough," "Savage," "General Monk," "Queen Charlotte," "Lady Prevost," "Epervier," "Cyane," "Levant," "Linnet," "Reindeer," "Penguin," "Nautilus," from the British; the "Berceau" from the French, and the "Daniel Webster" and "Lancefield" from the Japanese. Strange names, these last, for Japanese ships, but read about MacDougall in the "Wyoming" in 1863, and see what American sailors have done when boldly and skillfully led. Our list of captures is so large that we would never reach the end of it. From the British alone in equal combat we have caused the surrender of 5 frigates, 29 sloops and brigs, and 23 small craft, to say nothing of privateers—British, French, and Tripolitan. Of all our captures, there are at present on our navy list but five. "Detroit" (British flagship at Lake Erie), and the "Jason," "Frolic," "Boxer," and "Alert."

It is something to remember that ours is the oldest man-of-war flag now afloat. It was adopted in 1777. Next in age comes the man-of-war ensign of Spain (1785), then France (1794), Great Britain (1801), Portugal (1830), Italy (1848), and Germany (1871.)

Now this subject of ships' names does not end here. There is a curious custom in our own and the British service. Whenever one of us lost a ship to the other, the name of that ship was not lost but was promptly applied to another ship, even though the captor might have adopted the new name.

On our own list to-day we have "Vixen," "Eagle," "Rattlesnake," "Scorpion," "Essex," "Raleigh," "Chesapeake," "Ohio," "Somers"—every one of these has been taken from us by the British. Likewise the British have the "Hawke," "Alert," "Druid," "Magnet," "Jason," "Boxer," "Hunter," "Reindeer," "Avon," "Confiance," "Linnet," "Penguin," "Racehorse," "Caledonia"—every one of these we captured from the British. Some of our captures from the British, it will be noted, had been taken from the French, such as the "Guerriere," "Cyane," "Epervier," "Confiance," "Trépassey." The following list shows what captured names we are entitled to:

From British: "Edward" (7), "Racehorse" (12), "Mellish" (10), "Druid" (14), "Drake" (20), "Serapis" (50), "Countess of Scarborough" (22), "Atalanta" (16), "Trépassey" (14), "Savage" (16), "General Monk" (20), "Little Belt" (22), "Guerriere" (38), "Frolic" (22), "Macedonian" (38), "Java" (38), "Peacock" (20), "Boxer" (14), "Detroit" (19), "Queen Charlotte" (17), "Lady Prevost" (13), "Hunter" (10), "Little Belt" (3), "Chippewa" (1), "Epervier" (18), tender to "Tenedos" (1), "Reindeer" (19), "Avon" (18), "Confiance" (37), "Linnet" (16), "Chubb" (11), "Firsch" (11), 12 gunboats (17), "Penguin" (19), "Cyane" (34), "Levant" (21), "Nautilus" (14), a schooner (10), "Detroit" (6), "Caledonia" (2), "Duke of Gloucester" (14), "Eagle" (1), "Black Snake" (1), a schooner (14), tender to "Severn" (1), tender to "Cerberus" (1), "Hawke" (6), "Bolton" (12), "Fox" (28), a brig (14), a brig (4), "Alert" (20), "Simcoe" (12), "Highflyer" (6), "Julia" (2), "Growler" (2), "Mary" (2), "Drummond" (2), "Lady Gore" (2), "Picton" (14), "Magnet" (14).

From the French: "Insurgente" (40), "Berceau" (24), "Retaliation" (14).

From the Barbary States: "Tripoli" (14), a frigate (22), "Meshboha" (36), "Transfer" (16), "Estido" (22), "Mashouda."

From the Japanese: "Lancefield" (4), "Daniel Webster" (6).

From the Mexicans: A brig (12), "Libertad" (1), "Alerta" (1), a light squadron.

From Spain: "Reina Christina," "Castilla," "Marques del Douro," "Argos," "Cristobal Colon," "Pluton," "Elcano," "Reina Mercedes," "Don Antonio de Ulloa," "Don Juan de Austria," "General Lezo," "Infanta Maria Teresa," "Almirante Oquendo," "Jorge Juan," "Leyte," "Sandoval," "Alvarado," "Isla de Cuba," "Isla de Luzon," "Velasco," "Vizcaya," "Furor," "Callao."

It is but fair to our gallant adversaries to say that the British took 38 vessels from us, the French 1, the Tripolitans 1, and the Mexicans 1, 16 of the British vessels being in fights and 22 captured by superior forces.

Now a curious thing about our old adversaries and ourselves is the number of vessels of the same name borne on our respective navy lists. Truly blood is thicker than water. We and the British have the following ships' names in common: "Cæsar," "Hannibal," "Essex," "Cumberland," "Lancaster," "Amphitrite," "Fox," "Porpoise," "Jason," "Rattlesnake," "Pike," "Boxer," "Petrel," "Ranger," "Shark," "Vixen," "Alert," "Dolphin," "Vesuvius," "Hawke," "Adder," "Enterprise," "Buffalo," "Supply," "Terror," "Raleigh," "Intrepid," "Arethusa." But it is a strange mixture. We give our colliers the names of their battleships, and the rest are a hopeless mix-up. England is very careful of tradition in naming her ships. She has the "County" class, and the "Admiral" class, and other classes. She gives her battleships the names of her great admirals, while our captains of the sea must be contented with torpedo-boat destroyers. The "Farragut" is 273 tons, the "Paul Jones" 420.

But, in conclusion, there is still a word to be said about ships' names that perhaps is the most soul-satisfying of all, and that is the custom of having in a ship prominently displayed on turret, bulkhead, or beam, the *names* that belong to *that name.*

Suppose we had a big battleship called the "Constitution." We round under her stern in our boat in coming alongside, and the very name thrills one. But on stepping over the gangway, there on her turret in letters of gold are: "1812, H. M. S. 'Guerriere;' 1812, H. M. S. 'Java;' 1814, H. M. S. 'Picton;' 1815, H. M. S. 'Levant' and H. M. S. 'Cyane.'" Everyone knows what that means, and those who do not can ask. Nearly all foreign ships have such names on them, or if taking part in some bombardment, boat action, or similar expedition, blazon the names on board for all to see, and to make Jack proud of the ribbon on his cap. Of the names at present on our navy list, these are ships entitled to such honors: "Raleigh," 1777, "Druid" (14); "Ranger," 1778, "Drake" (20), "Jason" (20); "Alliance," 1781, "Atalanta" (10), and "Trépassey" (14); "Constellation," 1799, "Insurgente" (40), 1800, "Vengeance" (50); "Enterprise," 1800, French privateers, "Seine" (4), "Citoyenne" (6), "Agile" (10), "Flambeau" (12); 1801, "Tripoli" (14), 1813, "Boxer" (14); "Boston," 1800, "Berceau" (24); "Wasp," 1812, "Frolic" (22), "Reindeer" (19), "Avon" (18); "Hornet," 1812, "Peacock" (20), 1815, "Penguin" (19); "Lawrence," 1813, Lake Erie; "Scorpion," 1813, Lake Erie; "Somers," 1813, Lake Erie; "Rattlesnake," 1814, "Mars" (14); "Eagle," 1814, Lake Champlain; "Preble," 1814, Lake Champlain; "Porpoise," 1827, "Comet" (10); "Grampus," 1822, "Pandrita" (14), "Palmira" (9); "Wyoming," 1863, Shimonoseki, 1867, Formosa; "Potomac," 1832, Qualla Battoo; "Columbia," 1838, Qualla Battoo; "Petrel," 1846, Peruca; "Hartford," 1867, Formosa; "Colorado," 1870, Corean Forts; "Mohican," 1870, Forward; "Detroit," 1894, Rio de Janeiro; "Portsmouth," 1857, Barrier Forts.

What an inspiration to the new recruit is the contemplation of such names! There is so much in a name, especially a ship's name, and more than all in such ships' names as belong to us and our naval history.

SCIENCE NOTES.

The name Corosos, or Corozos, is apparently applied to several fruits, although in this country usually applied in commerce to the palm seed yielding vegetable ivory, i. e., *Phytelephas macrocarpa.* The fruit of *Elæis melanocarpa*, Gaertn., is called on the Pacific seaboard *Corozo colorado*, and on the Atlantic side of South America the fruit of *Attalea Cohune*, Mait., is known as *Corozo gallinazo.*—Journ. d'Agricult. Trop.

Capt. Lamb, I.M.S., has made a series of experiments upon the action of the venoms of the cobra and of Russell's viper (*Daboia Russellii*) upon the red-blood corpuscles and upon the blood plasma (Scientific Memoirs of the Government of India, New Series, No. 4). Both these venoms are shown to have a marked hæmolytic action, both *in vivo* and *in vitro.* Cobra venom never induces intra-vascular clotting; in fact, it rather diminishes blood coagulability, while Daboia venom causes extensive intra-vascular clotting. *In vitro* cobra venom prevents the clotting of citrated blood or plasma which ensues on the addition of a soluble calcium salt; Daboia venom, on the other hand, increases the tendency of citrated blood and plasma to coagulate. In conclusion, Capt. Lamb considers that his experiments do not support Martin's hypotheses that all snake venoms contain at least two toxic proteids, one being a neurotropic and the other a hæmotropic poison, and that the action on blood coagulability is due to a setting free of nucleo-proteids.—Nature.

In a paper recently read before the Académie des Sciences, M. Yves Delage states that he has made a series of experiments upon artificial fecundation of eggs of some of the inferior animals, particularly marine specimens, and has been successful in certain cases. In the case of some species he was able to replace the natural fecundation by the action of carbonic acid gas. Non-fecundated eggs which were treated with sea water charged with the gas were observed to develop normally. It is to be remarked, however, that all the eggs are not adapted to develop by this process. To do so it is necessary that the eggs should be in the act of performing a certain physiological function which is required for all eggs to render them capable of fecundation. This action consists in the emission of "polar globules." The eggs which have already completed this function are no longer sensitive to the action of the carbonic acid. This latter phenomenon he observed in the case of sea-urchins. M. Delage states that at present he is able to sensitize these eggs and also to render them capable of being developed by the action of carbonic acid. This he accomplishes by shaking them up in a closed vessel and heating them to 30 degrees.

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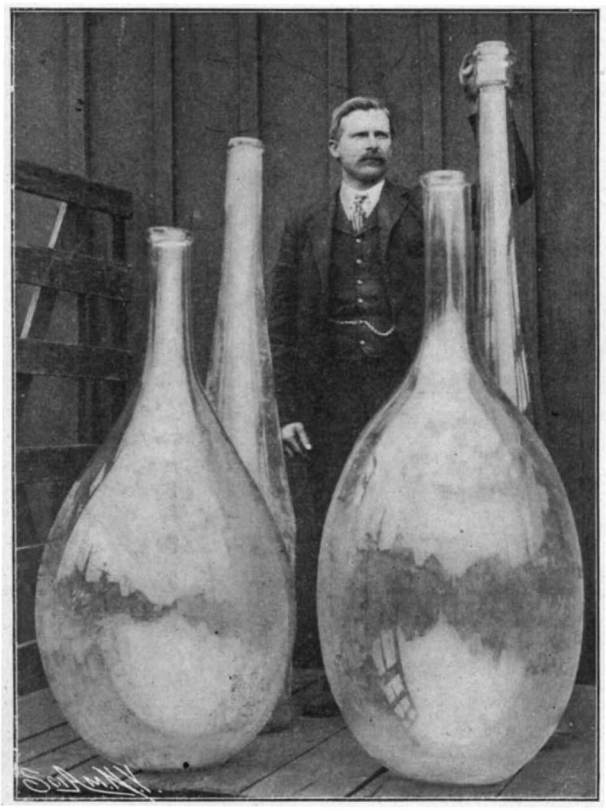
SOME LARGE GLASS VESSELS.

A feat in glass blowing was recently performed at a Western plant for making bottles which, it is believed, is unequaled in its way. An order was given for four bottles to be used for advertising purposes. Two were intended for perfume, another for wine, and another for toilet water, the idea being to make a show-window



A FEAT IN GLASS BLOWING.

display of these articles. As a result the quartet were produced which are illustrated in the accompanying photograph. By comparing them with the man standing in the rear, an idea can be gained of their truly mammoth dimensions. The bottles range in height from 5 feet 4 inches to 6 feet 4 inches. The largest bottle is 30 inches in diameter at its greatest width, holding no less than 55 gallons liquid measure. The smaller ones are intended for perfumery, and it is a fact that a single one of these will contain the contents of nearly 1,500 of the ordinary-sized perfumery bottles used on toilet tables, while the wine bottle represents the capacity of 250 ordinary pint bottles.

As already stated, these huge receptacles were made in the usual manner at the works of the Illinois Glass Company at Alton, Ill. Three of the most expert blowers were employed, and the quantity of liquid glass required for the largest bottle was no less than 50 pounds. This was drawn, rolled, and inflated, the blowpipe used being 5½ feet in length. Owing to the quantity of material needed, it was necessary to reheat it several times in order to complete the process; but as the photograph shows, the bottle is very well proportioned. In this portion of the work about an hour was required, after which the rings at the mouth were finished and the glass annealed in specially large ovens.

The bottles have been completed for a firm of druggists in St. Louis, and are placed in the show window, where they attract much attention. D. A. W.

A STILL FOR AMATEUR AND CLASS-ROOM WORK.

BY THOMAS R. BAKER.

A simple, inexpensive, and very efficient form of still, suitable for class-room and amateur purposes especially, is shown in the accompanying cut.

The vessel in which the liquid to be distilled is heated is a Mason quart fruit jar. A jar with an all-zinc top must be used, and the porcelain disk be broken out. The distillate tube is a piece of half-inch tin-lined lead pipe about three feet long. One end of the tube, curved at a somewhat acute angle with the long section, is fitted into a hole made through the top of the zinc cover, and soldered to the cover. This tube is passed through a tube made of tinned iron, or other sheet metal, about two and one-half feet long and two inches in diameter. The ends of the large tube are closed about the smaller one by passing the latter through holes in stoppers fitted to the ends of the large one. The large tube has short lateral tubes at its ends.

This arrangement will allow water to run into the large tube at its lower end and out at its upper end. This condensing apparatus is a form of Liebig's condenser. The condensing may be more simply done by wrapping the tube with a strip of loosely-woven fabric, adjusting it in an inclined wooden trough, and letting cold water run slowly upon its upper end, or the condensing will be more complete and rapid if cold water be allowed to drop upon the pipe at places two or three inches apart throughout its length from a vessel suspended above it.

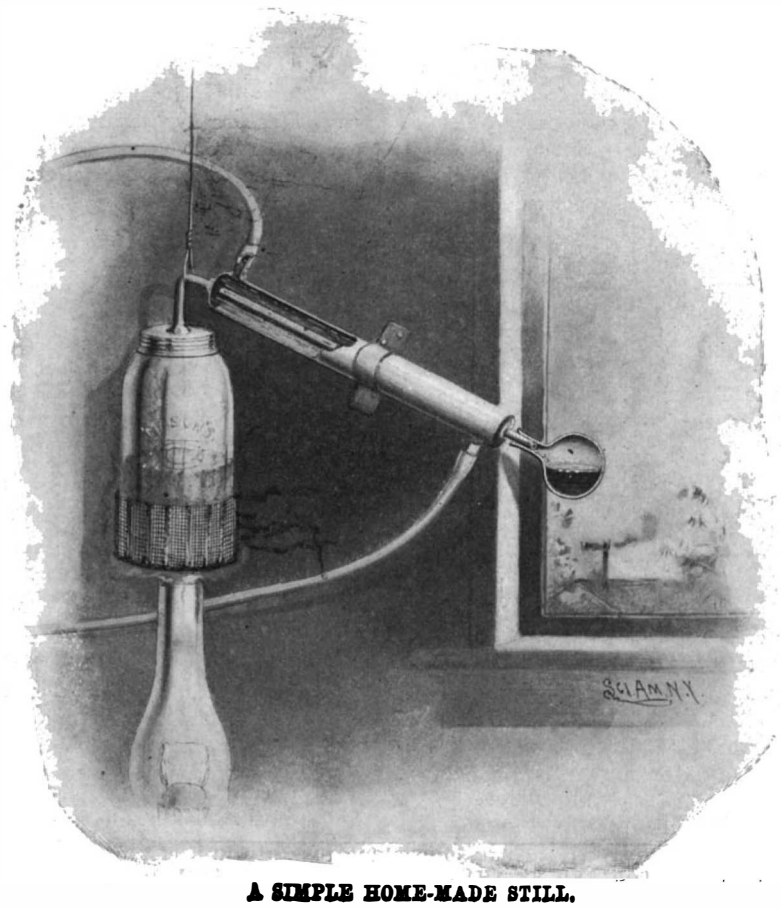
The bottom of the fruit jar should be covered with a piece of wire window screen to distribute the heat. A woven-wire hood or cap may be made for this purpose, to easily slip on and off the jar by properly folding a piece of the screening about six inches square.

The heating is best done with an ordinary kerosene lamp, as a gas or an alcohol flame might break the jar. The flame should be low at first, and the heat increased slowly. The contents of the jar will soon begin to boil, and there is little danger of the vessel's breaking with the strongest heat that the lamp can give.

I have the condenser of my apparatus attached to the woodwork of a window of my classroom. The lamp is supported on a shelf attached to an adjacent wall, and the distillate receiver is opposite one of the window panes.

The jar is supported by the cap, soldered as above stated, to the end of the condensing tube, and is simply screwed into place when the jar is charged for heating, and unscrewed when the jar is to be emptied. It is best to use two rubber bands, in order to secure a good joint between the cap and the jar.

I have used the apparatus a great deal and very profitably in class instruction to show the preparation of alcohol, essential oils, products obtained from flowers, and to obtain various other distillates; and it might be very conveniently employed in various amateur pharmaceutical operations.



A SIMPLE HOME-MADE STILL.

TWO NEW HACK SAWS.

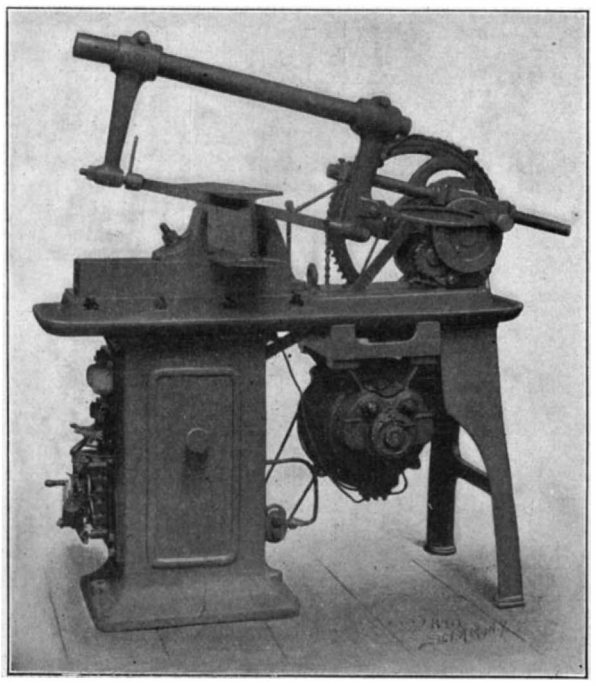
A new type of double hack saw for cutting steel girders and similar structures has been devised by Mr. Whitley, of England. The machine is distinguished by its increased capacity, double speed, and continuous cutting. It is designed on quite new and novel lines, and yet is simple in principle and construction. It has two saws working alternate strokes, a saw being placed on either side of the section to be cut, as may be realized from the illustration. By this arrangement the time occupied in the cutting operation is only half of that required to accomplish the same task by means of one saw. An evidence of its speed is shown by the sawn pieces of a 12 x 5-inch girder in the engraving, which were cut off in less than twenty-five minutes.

The machine is substantially constructed, and instead of being fitted with vises to hold the material to be cut, it is provided with a planed slotted table on which any section, regular or otherwise, can be bolted. Another prominent feature of the contrivance is that it will cut at any angle, even sawing the webs out of crank-shafts.

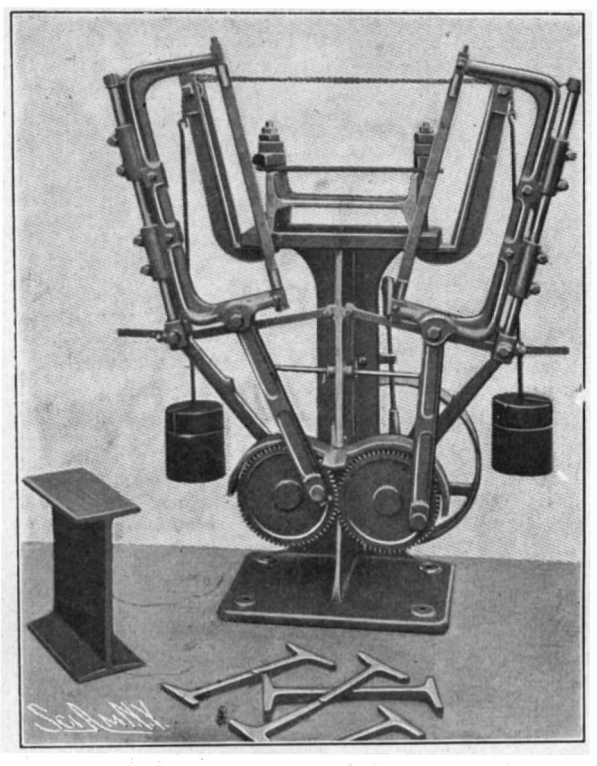
The bows or arms carrying the saws are stoutly and strongly constructed, so that it cannot get out of order, and to insure true cutting. By means of a novel attachment the blades are inserted perfectly straight, and in cutting through a 12 x 5-inch girder, for instance, the blades will not deviate 1-32 of an inch.

The feed is simple and direct, dispensing with the necessity of ratchets or other wearing devices. There are two weights attached to chains on either side, one connected to each bow. The latter is thereby drawn forward independently, and the feed can be suited to the keenness of the blade or the nature of the material to be cut, by means of the weights. The chains can be unhooked, and the bows at once thrown back to insert or remove the work. The bows are held back in any position by catches on the rods, which may be seen projecting at the right and left of the machine just above the weights in the illustration. By a novel and simple arrangement, one of the bows on reaching the center of the cut is pushed back sufficiently to permit the other bow to come through and complete the cut.

The gear wheels are machine-cut, and the slides or guides are adjustable, so that all wear can be taken up. The machine is very compact, and only weighs 3½ hundredweight. It will take material up to 14 x 9 inches. The stroke is 5½ inches; the table, 16 x 8



AN ELECTRICALLY-DRIVEN HACK SAW.



NEW TYPE OF DOUBLE HACK SAW.

inches; the pulley, 14 x 3 inches, with 65 revolutions per minute; and the blades, 17 x 1 inch, 16 gage. The machine constitutes a handy and quick-working tool for this class of work.

Another English saw, which deserves attention, is the invention of Mr. Edward G. Herbert. It is designed to replace circular and band saws, which are high-priced and expensive by reason of their consumption of energy and cost of maintenance. This saw is characterized by the inclination of the blade, which changes periodically by means of an eccentric movement that causes the blade to cut constantly at an angle instead of distributing its action over the entire width of the piece to be sawed. The speed with which the sawing is accomplished is greatly increased thereby, and may be still further augmented by the use of an arrangement that produces a circulation of soap-suds. In this case, the machine is capable of operating at 100 revolutions a minute.

The machine, which is represented in the accom-

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panying figure, is capable of sawing bars and girders of 8 x 12 inches. The motor, which is situated under the table, is of the constant speed, inclosed type. It is designed for a speed of 600 revolutions a minute. The driving shaft of the saw is run by a chain, and a speed reduction of 6 to 1 is employed, which gives it a speed of 100 revolutions a minute. The rheostats are fixed to the pedestal, and this permits of the machine being moved about bodily and especially of being lifted by a crane, since there is a ring secured to the machine for this purpose. The current for operating the motor may be taken from an electric light main by means of flexible wires and a lamp socket. The pedestal contains a tank for the lubricating fluid. The table is surrounded by a gutter, and a small force pump, with accessories, keeps up a constant flow of the lubricant. The saw clamp may be fixed obliquely, so as to allow the blade to saw girders, etc., at an angle. It may even be removed, so that the pieces may be bolted to the table itself, which is provided with T-mortises.

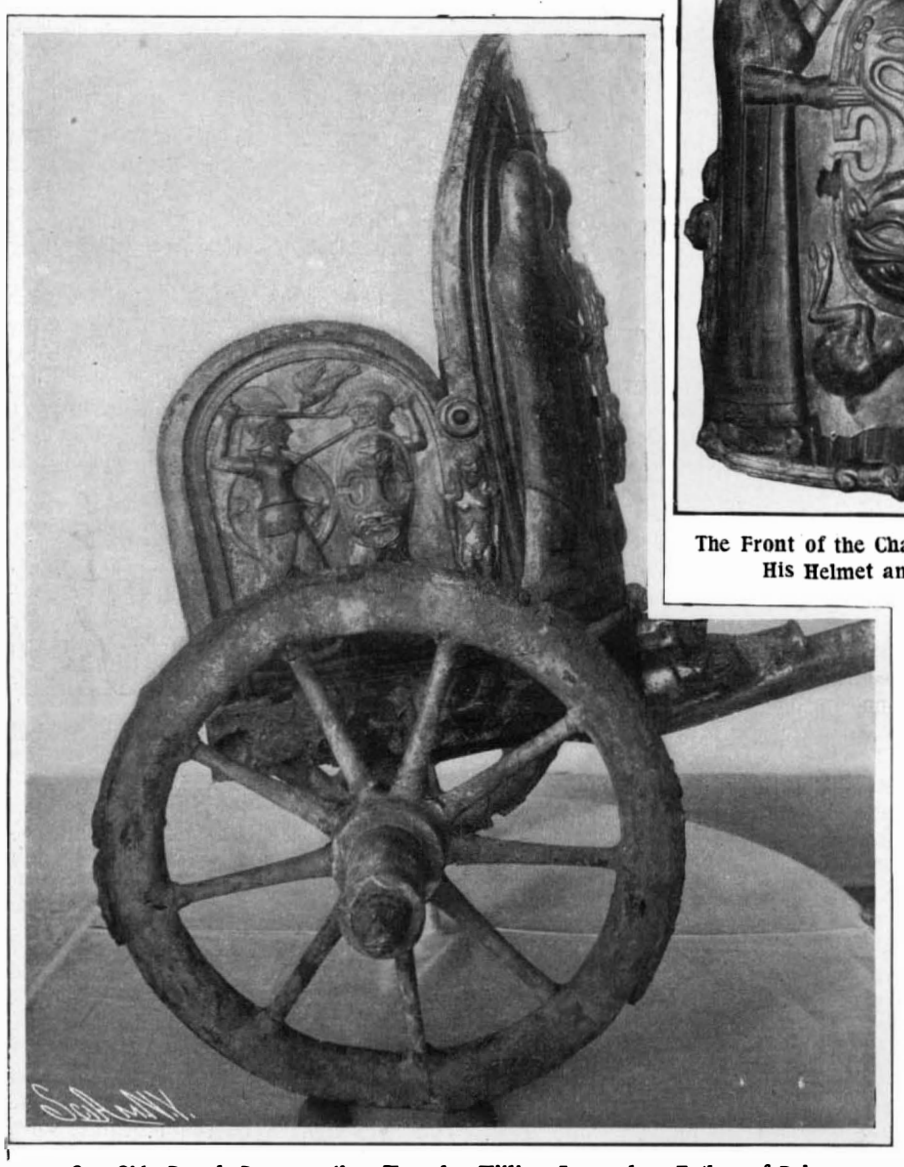
The machine, which may be driven by other kinds of motive power than electricity, will probably soon be adopted by metallurgical works and iron establishments, and be utilized at places where metallic constructions are in course of erection, where it will undoubtedly render valuable services.

A REMARKABLE EARLY GRÆCO-ROMAN CHARIOT.

Last January Gen. Di Cesnola, director of the Metropolitan Museum of Art, learned that there was offered for sale in Paris a chariot which had been dug up by some peasants in Italy at the foot of a hill called "Il Capitano," beneath which the road from Monteleone led to Norcia, the ancient Etruscan city of Nursia, fourteen miles distant from Viterbo. The price asked was more than even some of the most richly-endowed institutions could afford to pay. Through the munificence of the late Jacob S. Rogers, the well-known locomotive builder, who bequeathed much of his large fortune to the Metropolitan Museum of Art, Gen. Di Cesnola was enabled to buy the relic for 250,000 francs ($48,382). The *biga* has now been mounted for public inspection in the museum, and forms not only a rare example of pre-Roman art, but also a most skillful bit of restoration.

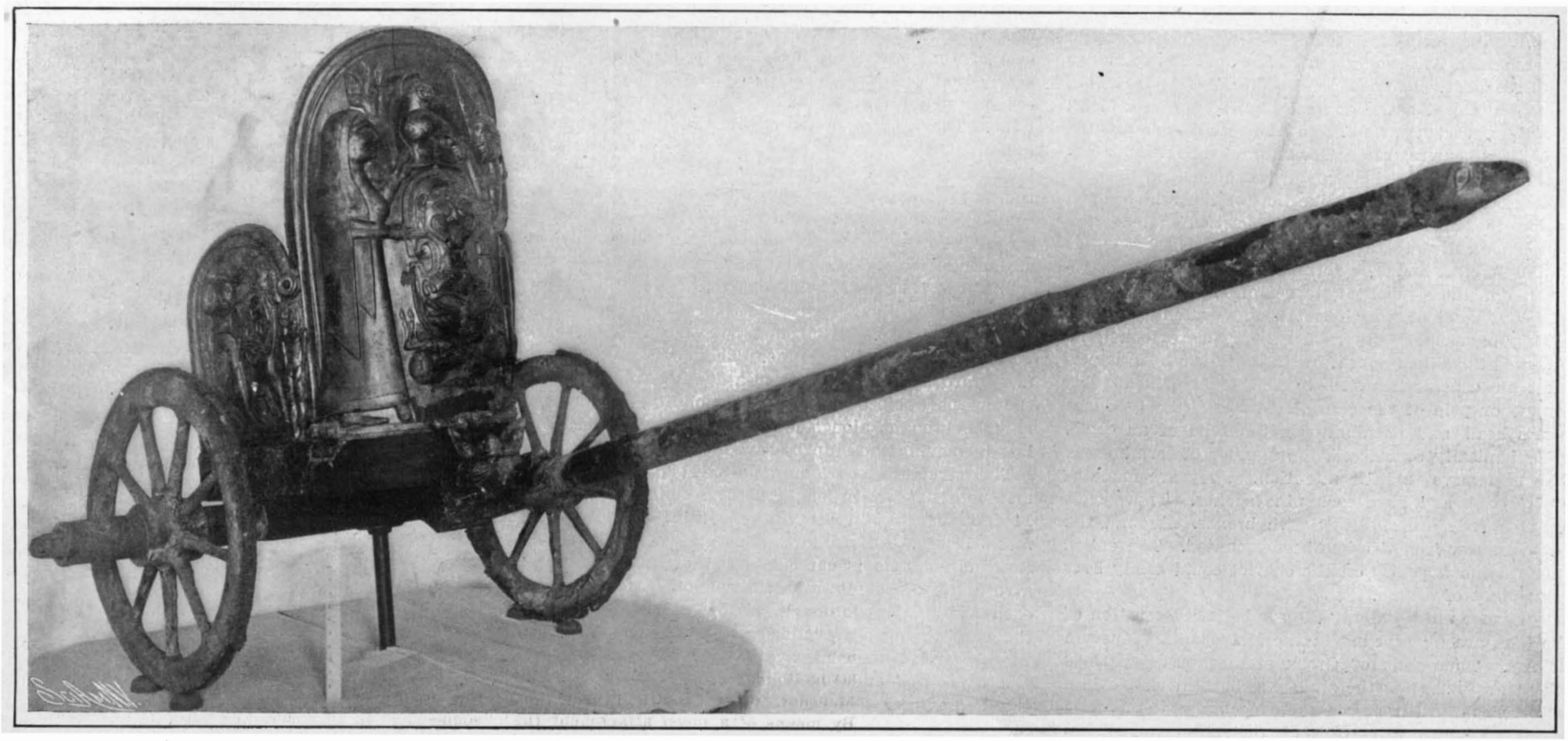
The chariot was found in a sepulcher amid a litter of earth, rubbish, and scattered utensils. Although the wooden body had crumbled into dust, still the few remnants showed that black walnut was the material which had been used in its construction. The ornamented bronze sheathing which covered the frame was found in a most remarkably well-preserved state. There seems to have been an ivory rim for the chariot body. The ivory fragments have been carefully preserved, and a few have been mounted upon a

The Front of the Chariot. Hercules Presenting His Helmet and Shield to Minerva.



One Side Panel, Representing Hercules Killing Laomedon, Father of Priam.

The Other Side Panel, Representing Hercules Killing One of Laomedon's Children.



AN ETRUSCAN BIGA OR CHARIOT, USED PROBABLY ABOUT 600 B. C., FOUND AT NORCIA, ITALY, AND ACQUIRED BY THE METROPOLITAN MUSEUM OF ART.

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wooden rim shaped exactly like that which was once fitted within the chariot body.

Such is the delicacy of its workmanship, that the vehicle could hardly have been used as a war chariot. Perhaps it was an *ex voto*, or a ceremonial chariot used by its noble owner on rare occasions. Its workmanship is so delicate that it could hardly have withstood the kick of a horse. Indeed, a frieze that runs about the bottom of the body seems to have been partially destroyed by the heels of animals. In size, the *biga* is quite small. Its entire height is not more than four feet; the wheels have a diameter of about two feet. The thin plates of bronze with which the chariot is covered are elaborately ornamented with symbolical figures, and with decorations so minute that they hardly appear in the photographic reproductions herewith presented. The horses which drew the vehicle must have been small, probably not larger than ponies, judging from the length of the pole.

The copper throughout is hardly as thick as a thin sheet of cardboard. A small nude figure is placed at either side of the central panel at the juncture with the others, and a sculptured band, parts of which have probably been kicked away by the horses, runs around the chariot below. The wheels have no decoration except that eagles' heads appear at the ends of the axle.

The meaning of the figures on the front and side panels has not as yet been definitely determined. The *motif* of the front panel is the passing of a shield and helmet. Alexander S. Murray, the British Museum's well-known authority, has given it as his opinion that the decoration represents Thetis handing a shield and helmet to Achilles. Gen. Di Cesnola believes that the figures are those of Hercules and Minerva, basing his theory upon the manner in which the objects are passed. When one soldier offers his helmet to another, he does it so that the recipient can most readily place it upon his head. From this circumstance, it may be concluded that the god is presenting the shield and helmet, and not the goddess. Furthermore, the symbolical decorations of the shield are those peculiarly associated with Hercules. At this early period of art, the lion's head, the emblem of Hercules, was not placed upon the hero's head, but was confined to his shield, a fact which the director of the museum has had ample opportunity of verifying in the admirable Cyprus collection forming a part of the museum's treasures. Curiously enough, the shield has been placed so that the lion's head appears at the bottom in an inverted position. Still another feature of the decoration of this front panel, which bears out the assumption that the figures are those of Hercules and Minerva, is to be found in the votive offering of a doe, which graces the bottom of the panel beneath the shield. From time immemorial it was the custom of Greek warriors to sacrifice to the temple god when any favor was asked. Obviously, in transferring his shield and helmet to Minerva, Hercules is beseeching divine favor, and his prayer is accompanied by the usual sacrifice of a living thing.

The side panels, according to Gen. Di Cesnola, also symbolize the deeds of Hercules. The panel to the left probably represent Hercules killing one of Laomedon's children. A brief recapitulation of the myth will show how plausible the theory is. Laomedon was the son of Ilus and Eurydice, the father of Priam, founder and King of Troy. For an offense against Poseidon he was forced to offer his daughter Hesione to a sea monster. Hercules found her chained to a rock, and agreed to free her for a pair of magical horses which Zeus had given to Laomedon in exchange for Ganymede. Laomedon failed to keep his promise. Hercules waged battle against him, slew him and all his sons, except Priam. In the panel, one of the daughters lies prostrate. The triumphant Hercules has secured the magical horses and has harnessed them to a chariot, in shape much like that of the vehicle upon which the decoration appears. Particular attention should be called to the peculiar curving of the wings of the magical horses, a formation which is found frequently in the symbolical statues of archaic Greek art. The left panel of the chariot may represent Hercules killing Laomedon, father of Priam. Here it will be observed the shield appears with the lion's head uppermost in contradistinction to the front panel. The tongue or pole of the chariot emerges from a bronze boar's head, and terminates in the head of an eagle.

Mechanically considered, the manner of forming the wheels deserves a little attention. They are made of stout wood, and have each nine spokes. The spokes and the felly are sheathed with bronze. Around the felly a heavy iron tire has been mounted. The entire construction is such that the chariot could easily bear the weight of a man.

The means for studying the symbolical decoration of the *biga* are all at hand in the Metropolitan Museum of Art. Thousands of Greek statues of all periods which are placed at the student's disposal enable him to determine with considerable accuracy the precise period to which this work of ancient craftsmanship belongs, and to fix with some definiteness the probable significance of the allegories depicted. The peculiarly-shaped shield is found in many little statuettes in the Cyprus collection. The representation of Hercules with a pointed beard, and the shield with the lion's head, both find their counterparts in many figures. Convincing proof is thus afforded that the figures represented are probably those of Hercules, Laomedon, and Minerva. Still, the question is one which has by no means been definitely answered, and which will undoubtedly give rise to no little discussion among archæologists.

Like Egyptian art, the art of the Greeks, Romans, and Etruscans in its earliest stages was severely fettered by religious conventions. The deities could be represented only in the traditional way. The ornaments of their shields and head-dresses were those which religious belief had associated with them. It is, therefore, a matter of no great difficulty to fix precisely the characters which are represented in many of the archaic statues of Greece and Italy. It is thus that we are enabled also to determine the time to which a given work of art belongs. We know that it was only after 600 B. C. that the head-dress of Hercules was a lion's head, and that before that time the lion was also placed upon his shield. We also know that in the earlier statues he appears with a pointed beard. It is by the study of such details that the date to which this chariot belongs has been placed with a fair degree of certainty between 700 and 600 B. C.

The treatment as a whole is archaic, technically extremely good and decoratively extremely felicitous. When it was new the chariot must have been a gorgeous sight. The eyes of the goddess and the warrior in the central panel, the eyes and lips in the panel of the Medusa, and the eyes of the animals had all been enameled. The reliefs too were very lightly gilded.

The bits of the horses and the yoke by which they were harnessed have also been preserved. A chart has been placed within the case of the *biga*, which shows very clearly how the yoke was probabaly attached to the pole. In passing, it may be well to mention that the jointed bit, which we are accustomed to regard as a modern invention, was a type used by the Etruscans, judging from that which has been preserved.

HUNDRED-TON NAVAL FLOATING CRANE.

In the work of a great naval dockyard like that of the New York navy yard at Brooklyn, there is a constant effort to reduce the handling of heavy material to a minimum—a most important consideration where such heavy weights as boilers, guns, and gun emplacements have to be handled. In past years this navy yard has suffered for want of adequate accommodation for the many ships that frequent it annually for repairs and refitting; and it has long been felt by the officers in charge of the various departments, particularly that of Construction and Repair, that a remodeling of the yard and the plant would mean a great saving of time and cost of work that is done there. Several years ago an exhaustive plan for the reconstruction of the yard was presented, and after the usual exasperating delay on the part of Congress, the changes were authorized and are now being carried out. These include the construction of a series of parallel docks, some of them extending from Cob dock into the East River, and others extending from the mainland into the channel between the Brooklyn shore and the Cob dock. At the same time large additions were made to the plant on shore, many new buildings were erected, and up-to-date appliances for the transporting and handling of material installed. One of the most important machines which has recently been put in service is the large 100-ton floating crane which is illustrated on the front page of this issue. The crane is designed for the special work of handling turrets, heavy guns, armor, or other massive pieces of material which may have to be put in position on warships or removed therefrom during the course of repairs. We illustrated a few weeks ago a large crane designed for this purpose, and erected at a German shipbuilding establishment. That crane was of the fixed type, being located at the edge of one of the docks, and, of course, if any ship is to avail itself of its services, it must be warped into proper position alongside the crane. The new crane at our navy yard has been built upon a floating pontoon, with the special object of securing mobility, so that it may be brought alongside of a vessel, and the time lost in moving the ship be saved.

The structure consists of a steel pontoon which measures 100 feet in length by 60 feet in breadth and 11 feet 3 inches in depth, the normal draft being 9 feet 3 inches. Above the pontoon and parallel with its longitudinal axis is carried, at a height sufficient to give a lift of 45 feet and a reach of 45 feet beyond each edge of the pontoon, a pair of trusses which form the runway for a traveling crane trolley. The runway is carried upon massive latticed posts and struts, whose position and functions will be clearly seen in our engraving. The pontoon is divided into three compartments by two longitudinal bulkheads. The center compartment is given over to a 300-ton movable counterweight, the two outer compartments containing, one the hoisting and racking engines, and the other the boilers and coal bunkers. The counterweight moves over four lines of 100-pound steel rail, and it is operated by means of an endless wire cable, which passes from the trolley to sheaves located at either end of the pontoon, and from them is led to the drum of the racking engine. At each end of the pontoon is located a tank containing a non-freezable liquid, and each of these has a floating valve which rises and falls with any alteration of the level of the pontoon. The valve is connected to a longitudinal rod, which passes along the wall of the longitudinal bulkhead and serves by its movement to control the racking engine. The mechanism is so arranged that the movement of the counterweight may be automatic, or may be directly controlled from the engineer's platform. Its action is such that when a heavy load is being lifted, the counterweight is drawn back toward the opposite end of the pontoon, to a position in which equilibrium will be maintained and the pontoon kept on a level keel. An ingenious safety clutch is provided, as shown in our illustration. This consists of a pair of heavy wedges at each end of the counterweight, which are normally held clear of the counterweight by the pull of the wire rope by which the counterweight is moved. The wedges are keyed to a horizontal shaft carried at the front of the counterweight, which has a horizontal projecting arm at its center, to which the racking cable is securely attached. Ordinarily the pull of the cable keeps the wedges lifted clear of the car; but should the cable carry away, the wedges will swing down with their own weight and become engaged between the car and the floor of the pontoon, preventing any further movement.

The hoisting ropes are of 1⅛-inch plowed steel, there being eight parts to each block. The hoisting engine cylinders are 12 inches in diameter by 15 inches stroke, and they run at a speed of 200 revolutions per minute. The counterweight engine cylinders are 11 x 18 inches, and the speed of hoisting with a full load of 100 tons is 8 feet per minute; with 50 tons on one block, 9 feet per minute; while the speed with a light load is 25 feet per minute.

The Hatching of Chickens from Preserved Eggs.

The London Lancet recently published an article describing some experiments which had been made for the purpose of determining whether eggs could be hatched which had been preserved for twelve months by immersion in a ten per cent solution of sodium. It was said in the article that chickens had been hatched from these eggs. A correspondent of the Lancet now writes to that journal, narrating some experiments which friends of his undertook for the purpose of verifying the statements made. Twelve eggs were collected in June, and immediately placed in a ten per cent solution of sodium silicate and completely covered by the solution. On September 5 four eggs were taken from the solution and marked and with nine other newly-laid eggs were placed under a hen. All the newly-laid eggs hatched out within three weeks, but the four preserved eggs did not hatch. One of these eggs was boiled and was quite fresh; the other three were broken and the yolk fell out separately from the white. The whites were whipped up and became quite stiff. This is stated to be the best test of a fresh egg. It is of interest to note that these preserved eggs, even when they had been incubated for three weeks, still remain perfectly fresh, seeming to indicate that the shells were still impermeable to external influences.

Assuming that the remarkable preserving effect of the sodium silicate is due to the formation of an insoluble glass with the lime salts of the substance of the shell it is curious that it has been possible to hatch out a chicken without first making the shell again permeable to air. The experiment is one which should be repeated after the shell has by some method again been rendered permeable, for it seems improbable that the hatching of such preserved eggs can take place if the shell remains impermeable to air.

The Current Supplement.

The current SUPPLEMENT, No. 1456, presents the first installment of an article on the Viennese Metropolitan Railway, a road which should be of no little interest to those who have been witnessing the development of rapid transit in New York, Boston, and Chicago within late years. The article is illustrated with photographs that clearly show the engineering features of the work. O. F. Cook writes upon the Central American rubber tree. D. E. Salmon, Chief of the United States Bureau of Animal Industry, read a paper at the recent Farmers' National Congress on Infectious and Contagious Diseases of Farm Animals and Their Effect on American Agriculture. The paper is republished in the SUPPLEMENT. Lord Kelvin in a pleasant way recounts his early training in natural philosophy, and presents an interesting picture of his first teacher. The usual Trade Notes, Selected Formulæ and Consular Reports will be found in their proper places.

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Aluminium Plate Printing.

BY PALMER H. LANGDON.

Revolutions in the industrial arts are becoming more common in these days of comparative peace than revolutions political, and such an industrial revolution is now taking place in the branch of printing known as lithography. It is a change which has come with the discovery of a new printing material—aluminium—and which has in turn made it necessary to build entirely new types of printing presses and to change the methods and shop practice of lithographic plants. Before describing this remarkable industrial revolution, it is essential that the various classes of printing be mentioned.

Printing may be classed under three heads. One method is relief printing, in which the design to be printed is raised above the surface of the printing plate. This method includes all type printing, which means that all newspapers come under the head of relief printing.

A second method is intaglio printing, in which the design is cut into a metal plate, the lines, etc., lying below the surface. Steel-plate printing is the most common form of intaglio printing, and intaglio is also popularly known in the form of calling cards, which are printed from engraved copper plates. Intaglio printing is practically limited to hand work, and is consequently slow and expensive.

The third branch of the printer's art is designated as surface printing, in which the design is neither cut below the surface nor is raised above the surface, but lies on the surface. By this method are printed the theatrical and circus posters, fashion plates, insurance policies, portraits, and the great bulk of prints produced in colors, and which are termed color work. Surface printing is far the youngest branch of the printing industry, for it was but a little over a century ago that Alois Senefelder, at Munich, Germany, discovered that a certain quality of lime rock now known as lithographic stone had the property of absorbing sufficiently a design or drawing in ink, to make a reprint of the very drawing without raising or depressing any part of the stone surface.

A picture or design is drawn upon the stone in greasy ink; this the stone absorbs. By washing the surface with an acid solution and gum arabic, the greasy design is rendered insoluble in water, and at the same time those portions of the surface not occupied by the greasy design have attached to them a film of gum arabic, which has an affinity for water. Water and grease will not mix—they are mutually repellent. It is upon this principle that surface printing is based. When the design is ready to print, first a wet roller is passed over the surface—the water adheres to the surface everywhere except where the greasy design lies; there the grease rejects the water. Then the ink roller is passed over the same surface, and the water-covered portions reject the ink, which adheres only to the greasy design. The design being thus inked, the paper is pressed against it and receives an impression of the picture or design. But stone, fine as it is for surface printing, is a cumbersome, fragile material, and the supply is limited. If lithography was to grow like other branches of the printer's art, what was to take the place of stone, which was steadily increasing in price? Lithographers had many years ago experimented with the different metals, but none, with the exception of zinc, was found to possess the right texture and porosity essential for surface printing. Zinc, for which the lithographic trade had high hopes, proved to be of limited capabilities, and lithographers found again that they must rely on stone or find a more suitable material.

Some ten years ago aluminium began to be manufactured in a sufficient quantity to make it commercially useful, and it was soon discovered that this light, white metal could be treated in a way which would give it the property of printing like lithographic stone. The treatment of the metal differed slightly from the preparation of the slabs of the stone. Sheet aluminium was ground with pumice stone to give it an open grain, and then subjected to an acid treatment, which after a number of experiments was found necessary to give the plate the proper surface. The plates were then fastened on blocks, placed on the old flatbed presses, and it was but a short time before the experimenters were able to do creditable color work from aluminium plates. The new aluminium art had developed sufficiently to exhibit work at the centennial held in New York a few years ago to commemorate the discovery of surface printing.

However, the progressive minds were not content to print from aluminium plates in the old-fashioned way, but they must have a new style of machine to do the printing; and it is right here that the revolution is taking place in the complete change of surface printing machinery, which at the present time is going on in lithographic establishments all over the world. It is pleasing to record in passing that America has led in the revolution, and is supplying the revolutionary machinery—so to speak—to Europe, the Orient, and the Occident.

As long as stone was the only surface printing material, only one form of press, that known as the flatbed, was practical. This form of press has a heavy swinging bed, is of slow motion, and is noisy. With a metallic plate it was possible to bend the metal to a cylinder, thus applying the principle of revolution, and making it necessary to build a rotary press. When the press builders were convinced that printing from aluminium plates was no longer an experiment, they quickly put on the market a press especially built for metal plates, and by applying the rotary motion mentioned, were able to get twice as many impressions as from the slow-moving flatbed. With the rotary press it was simply passing the paper sheets between two cylinders, as clothes are passed through a laundry wringer.

When it had been demonstrated that the rotary press was a thoroughly practical machine, the builders decided to go a step further and build a press that would print two colors at one time—a two-color rotary. Never had it been commercially possible in lithography to print two colors from stone in one run through the old flatbed press. Inventors, lithographers, and press builders have striven for years to perfect a machine which would allow them to put on the various colors of a picture in one run through a press. Hundreds of thousands of dollars had been spent and years of time consumed toward this end, but without practical results. The application of surface printing remained the same as in Senefelder's day, viz., that each color is printed separately from the stone, and that if there were ten colors to form the complete picture, there must be ten separate prints made on the press, and each in perfect register with the others.

A perfect register is obtainable in a rotary press, and from the form of construction of the machine it was possible to put in a third cylinder and an additional set of rollers, and put two colors on the sheet of white paper before it had passed through the press. Great as this improvement is in surface-printing machinery, lithographers believe it is but a step to a three-color press, when by the wonderful finished effects which are obtainable with the combination of three colors, it would make three-color lithography, or more properly speaking three-color algraphy, a triumph in the graphic arts.

But it is not alone a gain in multicolor printing which has been brought about by the aluminium plate and the rotary press, but it is the great gain which is accomplished with the single-color rotary, and which at the present time is more widely used. The largest size stone generally used on a flatbed press measured 44 x 64 inches and weighed 1,200 pounds. The same size aluminium plate weighs but 12 pounds. It is possible to make 12,000 impressions a day from a rotary. With stone 5,000 prints is considered a good day's run. The motion of the rotary is continuous, while that of the flatbed is reciprocatory. The difference in motion of the two might aptly be compared with the difference in motion of the steam engine and the electric motor. With the introduction of the rotary there has been indeed a revolution in lithographic establishments, until some of the larger shops now print 90 per cent of their work from aluminium plates and rotary presses. As most of the lithographic plants are located in large cities where storage room is limited, the smaller space taken up by a plate is a particular advantage. A stone of the average size four inches in thickness requires thirty times the space of a one-sixteenth inch plate.

The revolution, however, is not taking place with the haste of the French revolution of history, but is a gradual change from the old method to the new. Stone and the flat bed are still used exclusively by the majority of the litho shops—though this majority is steadily diminishing—and particularly for the class of surface printing known as commercial work. Where there is no color work, stone is preferred. Commercial work borders on relief printing, and no method has as yet been devised whereby the aluminium can be etched high enough to print such fine lines as the stone. There is hope, however, that invention will give a process which will overcome this difficulty, and that even commercial work will be produced entirely from aluminium plates.

In the Zeitschrift of the German Engineers' Association, Mr. L. Austin describes experiments made at Charlottenburg on the co-efficient of thermal surface-conductivity across the surface of separation of a solid and a fluid, giving the following results: From metal to water at the boiling point the resistance is equivalent to a thickness of ½ centimeter to 2 centimeters of iron, but is reduced by stirring by an amount equivalent to about 0.75 centimeter of iron. The resistance increases as the temperature falls, reaching a maximum of 10 centimeters of iron, which is reduced by 1 centimeter by stirring. For flow of heat from water to metal, the resistance appears greater than for the reverse flow if the water is undisturbed, and about the same when the water is stirred.

Correspondence.

In Memoriam of Robert Henry Thurston.

To the Editor of the SCIENTIFIC AMERICAN:

The class of 1904, Sibley College, has requested that a copy of the following resolutions be sent to you, and we hope that you will favor us by publishing the same.

RESOLUTIONS.

Whereas, It has pleased the Almighty God, in His infinite wisdom, to call from among us our Head, Robert Henry Thurston, Director of Sibley College, Cornell University; be it therefore

Resolved, That we, the members of the Senior Class of Sibley College, individually and as a body, feel the loss sustained by this class and college to be unspeakable.

That we mourn him not only as our respected Teacher and Director, but as a true friend of every member of the class.

That we deeply appreciate the exceptional opportunities of having been under his instruction and of having enjoyed the advantages of personal contact with this ideal member of our future profession. Further be it

Resolved, That a copy of these resolutions be sent with our deepest sympathy to his bereaved family.

That a copy of these resolutions be published in the college papers and in the leading engineering journals of the scientific world; and

That a copy of these resolutions be duly engraved and placed in Sibley Hall.

CLASS OF 1904, SIBLEY COLLEGE, CORNELL UNIVERSITY.
HURD ALDRICH,
Committee: R. W. ROGERS,
W. S. FINLAY, JR.

Cornell University, Ithaca, N. Y., November 18, 1903.

The Ninety-Footers.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with great interest your article on the subject, "Is Yacht Designing an Exact Science?"

The anomalies you refer to in the relative performances of "Reliance" and "Shamrock" in light and strong winds can, I think, be shown to be not real, but apparent only.

You say experts predicted that "Shamrock" would relatively do better in light winds because of her lesser wetted surface. But the question of wetted surface must be considered *in relation to sail area*. "Reliance" had close on 2,000 square feet more sail, an area equal to "Reliance's" biggest jack yard topsail. She carried 14 per cent more sail than "Shamrock" on a hull of the same length of waterline, and allowing for "Reliance's" greater wetted surface, it is probable that "Reliance" carried at least 10 per cent more sail *per square foot of wetted surface*.

I contend that the performance of "Reliance" in light winds fully accords with theory if her sail area per square foot of wetted surface exceeds that of "Shamrock," about which there can be no doubt.

In regard to the relatively better performance of "Shamrock" in strong winds reaching, which should in theory be "Reliance's" best point, I think the comparatively good performance of "Shamrock" in strong winds can be accounted for in three ways: First, a cutter of such immense rig as "Reliance" would be more difficult to manage in strong winds and the small sail plan of "Shamrock" would be more effective in proportion to its size. Secondly, "Shamrock's" area of cross-section may be very little larger than "Reliance's," and if this is correct, her relative fineness of hull will be very little fuller. Owing to her shallowness of hull and extreme overhangs, "Reliance's" buttock and diagonal lines will of course be much finer than "Shamrock's," but "Shamrock's" water lines, on the other hand, are much finer, and consequently it is probable there is not much difference in the relative fineness of the hulls of the two boats. If these assumptions are correct, it is in accord with theory that "Shamrock" should develop high speed in conditions favorable thereto. Thirdly, the finer waterlines and sweeter form of "Shamrock" would of necessity cause her to take more kindly to rough water.

It will be remembered that in the trial races on the Clyde, while "Valkyrie III." could sail rings round "Britannia" in light winds, "Britannia" beat "Valkyrie" in strong breezes. The differences in type between these two boats were more pronounced than in the case of the "Reliance" and "Shamrock," but otherwise I think the cases are analogous.

ARCH. BUCHANAN.

Auckland, N. Z., October 15, 1903.

The new leviathan "Baltic," for the White Star Line of the Morgan shipping combine, is rapidly approaching completion at the Belfast shipbuilding yard of Harland & Wolff. This steamship when launched will be the largest vessel afloat, exceeding the "Cedric" by 3,000 tons. The tonnage of the "Baltic" will approximate 24,000 tons.

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A GRAPHIC ACCOUNT OF THE BERLIN-ZOSSEN RECORD RUN.

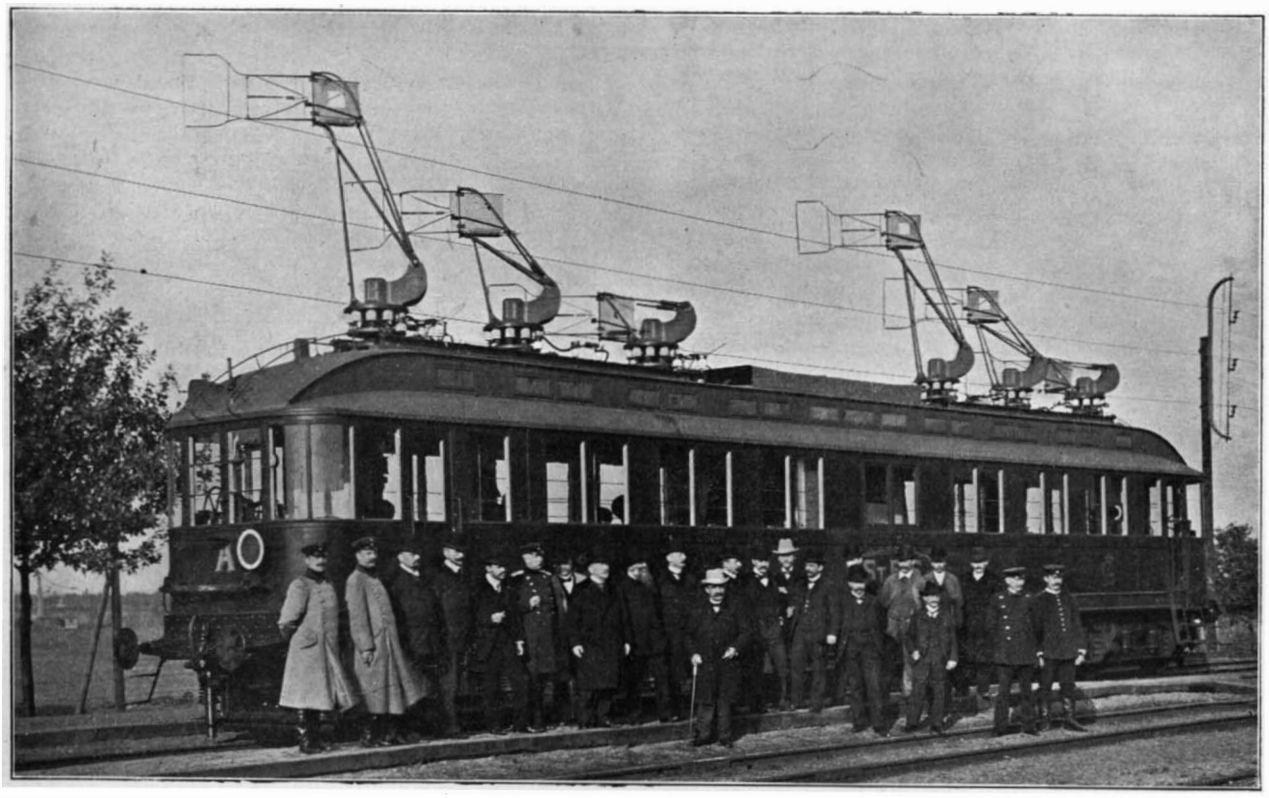
The attainment of the speed of 130 miles an hour on the high-speed electric road from Berlin to Zossen, which has been duly chronicled in these columns, has probably caused many of our readers to wonder just how the men in the cab felt when they saw poles and trees flying past. It happens that Dr. Reichel, one of the engineers who was in the car at the time it made its historical run, published in a Berlin weekly a very good account of the experience of those who conducted the experiments. We translate the more striking portions:

"All preparations have been made; a brake test has been carried out; the engineers have climbed into the car; and the military posts along the road have been informed that the car is soon to start. The motorman turns the controller very slowly through a few degrees. Fourteen thousand volts shoot from the lines to the motors. With a whirr the car starts on its memorable journey from Marienfelde at twenty-five minutes after nine o'clock. The overhead wires are swaying in a strong wind. As the car travels on, the strength of the electrical current fed to each of the four motors is gradually increased to 350 amperes. In other words, 2,300 kilowatts, or 2,600 mechanical horse power, are being expended. A mile and a quarter has been covered. The speed indicator shows a velocity of seventy-five miles an hour. When Lichtenrade is reached, about half a mile further on, the car is rushing on at 94½ miles an hour. Each second the speed increases. Just before the station of Mahlow appears, a curve of 6,560 feet radius looms up. The speed is now 109 miles an hour. We seem to be leaping toward the curve. No bend can be seen; the track apparently ends abruptly. We know there is a curve, and yet we are anxious; we brace ourselves for a shock. Just as we reach the curve the track seems to bend into a gentle arc into which the car runs easily.

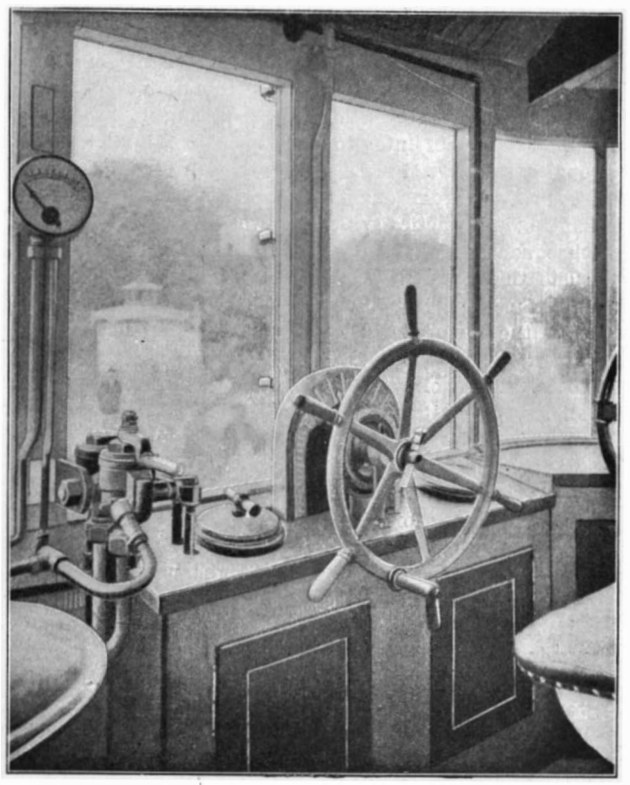
"The curve is passed. About a mile ahead of us a safety signal can be seen. We climb a grade of 26 feet to the mile—slight, to be sure, and yet to ascend it at full speed we must expend 300 horse power more. The train is flying on faster and faster. We rush through Mahlow (4 miles from Marienfelde) at a speed of 115 miles an hour. No vibration or shock is felt. It seems as if the car itself were not moving—as if buildings, poles, trees, were flickering past. Only the humming of the wheels assures us that it is we who are moving. The voltmeter shows that the current collectors are doing their work smoothly. No fear of increasing the speed need be felt. The last resistances of the controller are gradually cut out under the load of 2,300 kilowatts. The finger of the speed indicator slips along to a mark which shows that the car is making 121 miles an hour. At every crossing a loud ringing note can be heard, caused by the wheels.

"Fragments of ballast as large as walnuts are sucked up into the air and fall back as the train rushes on. At first the speed is bewildering, almost stupefying. We in the cab are much nearer the track than is the engineer of a steam locomotive. On that account it seems at first as if the car is literally devouring the road by the mile. Gradually we become accustomed to the new sensation. The feeling of safety and comfort which overcomes the first shock of amazement gives rise to the desire to travel still faster. After the 120 mile an hour mark has been passed, the excitement in the car becomes intense. Not a word is spoken. Only the click of the wheels over the rails is heard. Every eye that is not fastened on the speed indicator is glued on the track. Suddenly, at a distance of about half a mile, we see two men unconcernedly standing in the middle of the road calmly awaiting the car. The motorman jumps for the whistle string. As the danger signal shrieks, the two men on the track turn about with a frightened look, and then flee for their lives. No power on earth can stop this 93-ton car within a mile.

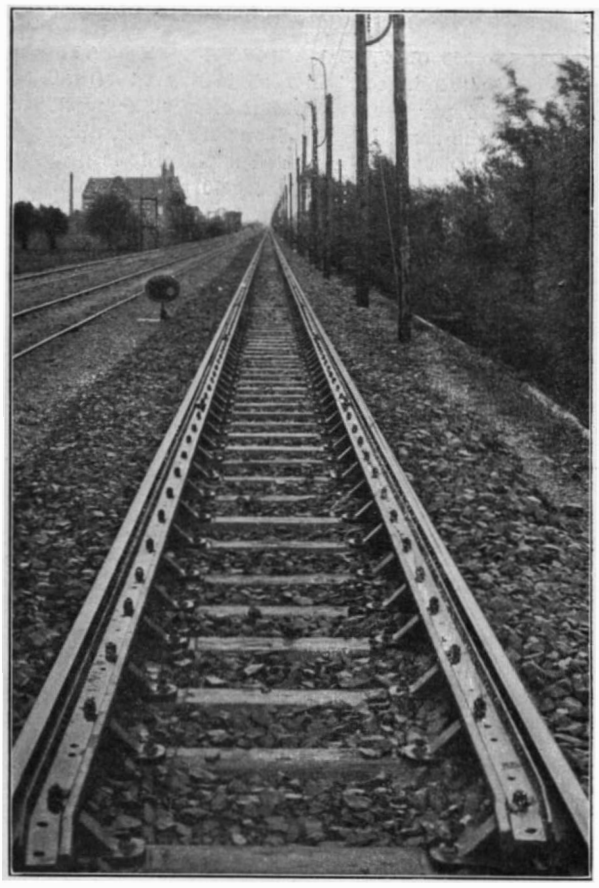
"We whizz past the town of Dahlwitz. Dust, sand, and large pebbles leap up behind us. We just catch a glimpse of people on the station throwing up their hats in joy. Suddenly a smashing blow is heard against the window of the cab, as if a man brought his fist heavily down upon a table. It was a bird, *overtaken* in its flight and killed. The speed indicator finger climbs up past the 124-mile mark. Rangsdorf is only 1¼ miles away (8.6 miles from Marienfelde). It is soon time to shut off the current. Unless the 4,000-horsepower engine at the power station at Oberspree does not help us, we shall not reach the speed for which we are all hoping. The engineers at the power house have not forgotten us. The finger of the speed indicator, as we near Rangsdorf, moves just a little further. And so we cover the last mile which we still have before cutting off power, at top notch speed, using up 1,400 kilowatts, or 1,600 horse power.



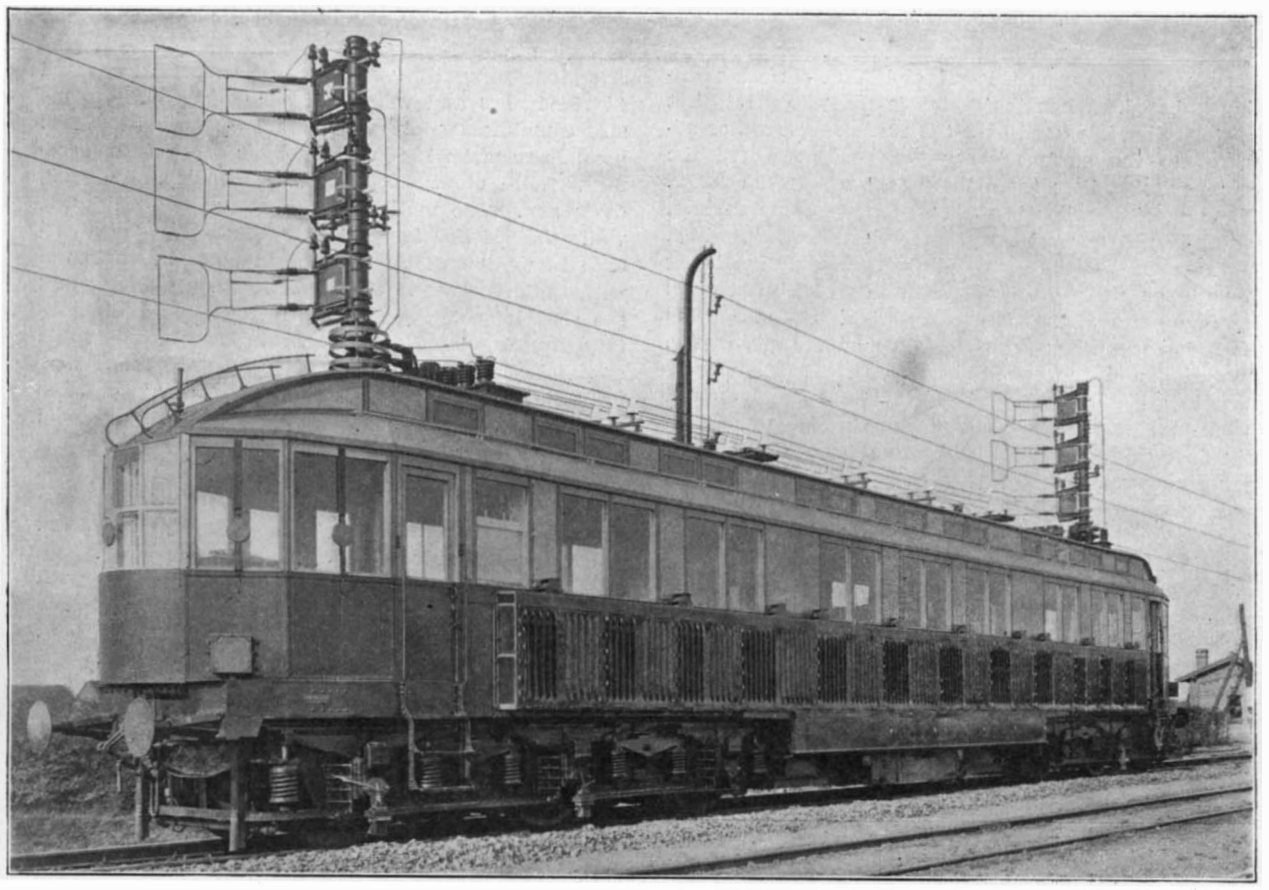
A View of the Car Which Made the Record of 130.4 Miles per Hour on October 28, Taken Immediately After the Run.



The Motorman's Cab.



The Track on Which the Record Run Was Made.



One of the Two Cars Built for the Speed Tests.

THE BERLIN-ZOSSEN RECORD RUN.

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A quarter of a mile before reaching the curve near Rangsdorf, we shut off the current and apply the full power of the brakes. The speed of the car drops to 102 miles. The curve is rounded in a noble swing. The brake is released, and the car glides along under its own momentum without any current whatever until Zossen is reached. In eight minutes we have leaped from Marienfelde to Zossen. We crowd around the telegraph instruments, which have recorded a speed never before attained in the annals of railroading. The telegrapher can hardly attend to his instruments, so many heads are pressing about him. Finally he succeeds in reading off the record—130.4 miles an hour. Everyone smiles; hands are shaken, congratulations exchanged. An officer rushes off to the telegraph station to announce to His Majesty the Kaiser the feat which German engineers have succeeded in performing.

"The front end of the car is covered with flies, bees, and small insects, crushed as if by a thumb against the iron and glass."

THE FINSEN LIGHT-CURE IN ENGLAND.

BY HERBERT C. FYFE.

King Edward and Queen Alexandra paid a visit the other day to the London Hospital in order to open three new departments lately added to the hospital. The first of these is known as "Queen Alexandra's Light Department," for Her Majesty was the first to introduce the Finsen light-treatment into England, presenting a four-tube lamp to the London Hospital in 1900.

In a large room of the London Hospital, ten lamps of various kinds are being used. In a smaller room cures are being effected by means of the Röntgen rays. The other two departments are the electro-therapeutic, where all kinds of electrical treatment are given, and the radiographic, where photographs are taken for the purpose of locating foreign bodies.

Dr. Niels R. Finsen is the director of the five new buildings in Copenhagen known as "Finsen's Medicinske Lysinstitut," which was founded by the Danish government. Since 1890 Finsen has devoted himself to work on phototherapy or the therapeutic influence of the various rays of the solar spectrum. His first great result was the red-light treatment for small-pox, which is now being used all over the world with splendid results.

The result of the red-light treatment is that suppuration is usually abolished. Scars are extremely rare, and the duration of the disease is shortened. Turning now with renewed energies to his chosen field of research, Finsen soon found that the chemical rays were of inestimable value in curing lupus and like eruptive skin diseases. He finally discovered his world-famous method of treating local superficial bacterial skin diseases by the concentrated chemical rays of light. The method is founded on the following facts, which have been proved after a long series of experiments:

1. That the chemical rays of light (particularly the violet and ultra-violet) are capable of destroying bacteria.

Prof. Finsen has found that, on days of bright sunshine, at noon, in July and August in Copenhagen, sunlight will kill bacteria in a few hours, and that an electric arc lamp has the same bactericidal property. But neither the rays of the sun nor of the electric lamp are sufficiently strong by themselves to kill bacteria growing in the skin; if they were, then all bacterial skin diseases would be cured spontaneously in the summer.

Prof. Finsen soon discovered that he must *concentrate* the light by means of special apparatus in such a way that it contains as many blue, violet and ultra-violet rays as possible. This concentrated light, whether it be sunlight or electric light, will kill in a few seconds bacteria which were destroyed by ordinary light in as many hours.

2. That the chemical rays of light can produce an inflammation of the skin; and

3. That these same rays have the power of penetrating the skin.

The Finsen treatment may be divided into two varieties: the treatment by sunlight and the treatment by electric light.

In the treatment by sunlight, the apparatus used consists of a lens of about 20 to 40 centimeters (7.8 to 14.7 inches) in diameter. The lens is composed of a plane glass and a curved one, both framed in a brass ring. Between them is a light blue, weak, ammoniacal solution of copper sulphate. As one surface of the liquid is plane and the other one curved, its optical function is that of an ordinary plano-convex glass lens.

In order to avoid burning the skin of the patient it is necessary to cool the light by eradicating the heat rays of the spectrum, and this the lens accomplishes. By making the lens of a blue liquid instead of solid glass, a considerable cooling of the liquid is effected, for the reason that water absorbs the ultra-red rays and the blue color excludes a considerable number of the red and yellow rays. These three kinds of rays have particularly strong heating effect, while their bactericidal power is insignificant. The blue, violet, and ultra-violet rays, which it is important to procure in as great a number as possible, are but very slightly impaired by passing through the blue liquid.

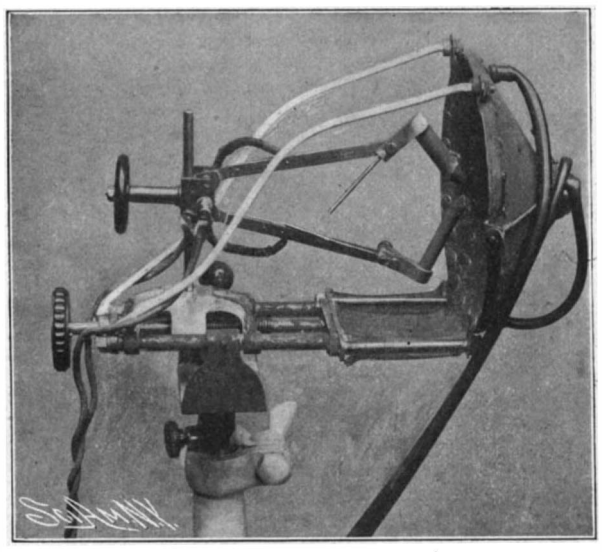
The lens can be raised or lowered as well as turned on a vertical and a horizontal axis, and thus is capable of concentrating the rays of light upon any portion of the skin which it is desired to treat.

Where sunlight is not available (in Copenhagen and London this is unfortunately very often the case) light from an electrical source is requisitioned. In the general arrangement of the original lamp is included a central electric arc, protruding from which are four brass tubes which remind one of telescopes. Each tube consists of two parts, inside of which are fixed lenses of quartz, used because this material to a far higher degree than glass allows the ultra-violet rays of shortest wave length to pass through. It is just these ultra-violet rays that have a considerable bactericidal effect.

The reason that glass and not quartz is used in the sunlight apparatus is that all ultra-violet rays of short wave length emanating from the sun have been absorbed by the atmosphere before they reach the lens and that the longer rays can quite easily pass through glass. Between the lenses in the tube there is distilled water, which cools the light by absorbing the intensely heating ultra-red rays, but does not impair the blue, violet, and ultra-violet ones.

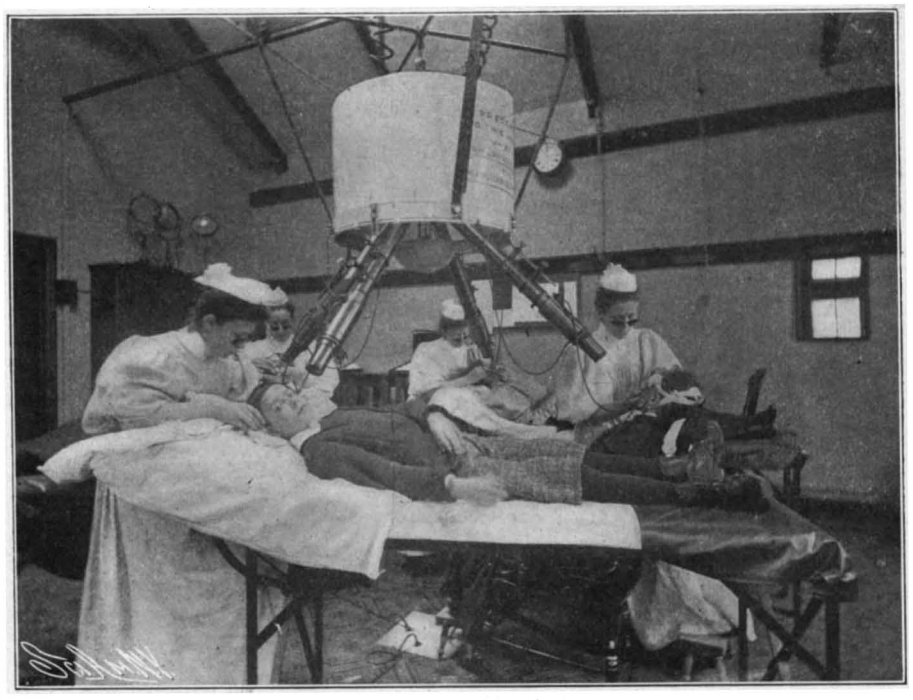
Dr. Finsen explains that it is not possible, as in the sunlight apparatus, to make the water blue in order to cool the light further, because the extreme ultra-violet rays which abound in the electric light might well pass the quartz but get absorbed by the blue coloring matter; the advantages of using the lenses of quartz would consequently be lost. In order to prevent the distilled water from boiling by absorbing the ultra-red rays, cold water is made to circulate around it.

Notwithstanding the fact that the special arrange-

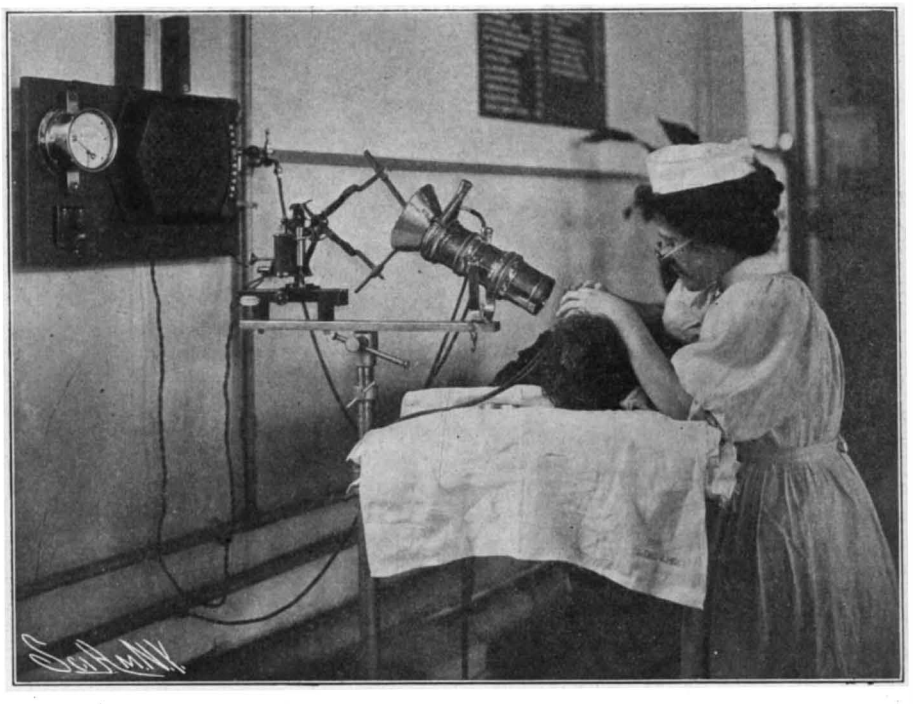


One of the New Ultra-Violet Ray Lamps Designed by the London Hospital Staff.

The Interior of the Finsen Medical Light Institute at Copenhagen.



Treating a Patient with the Finsen Apparatus Presented by Queen Alexandra to London Hospital.



Dr. Finsen's New Apparatus for Light-Treatment.

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ments we have been describing for cooling the rays both from the sun and from an electric lamp arc have been devised, the light is still in both cases too warm to be applied to the skin without injury, and it is necessary to cool the skin in order to avoid burning.

To this end a little apparatus is employed, consisting of a plate of quartz and a plain convex lens of quartz, both framed in a conical brass ring which carries two small tubes and four arms; to each arm is fastened an elastic band, by means of which the apparatus is pressed against the skin. By making cold water run into one of the tubes and out of the other, the skin can be cooled to such a degree that it can stand even the strongest light. Furthermore, the pressure which the plano-convex quartz lens excites on the skin makes it anæmic, and thus allows the chemical rays to penetrate much better than were this not the case. The red color of the blood acts like red glass in opposing the passage of any light but red. In treating patients, an area of skin of about 1½ centimeters in diameter is subjected to the light rays for one hour every day.

One photograph shows a lamp which was invented by the staff of the Lupus Department of the London Hospital. The earlier telescopic form is abandoned and the light from the carbon poles is simply passed through a water lens. It was found, however, that much better effects were obtained when the light rays were concentrated by means of lenses. The latest lamps are supplied with continuous current at 50 volts and 15 amperes. The original four-tube lamp took 45 amperes. Powerful lenses are placed in the telescopic tube, and distilled water is circulated through the tube.

Various other kinds of lamps have been tried at the London Hospital. In some, lenses of rock crystal are used. In the "Broca-Chatia" lamp one of the cores of the carbon rods is of cast iron which, it is claimed, gives ultra-violet rays three times greater than ordinary carbons, and will do as much for a lupus patient in 20 minutes as Finsen does in 1¼ hours. No water circulation is used, and the tissues need not to be pressed free of blood.

The original Finsen four-tube lamp costs about $500 and $2,500 a year to maintain in constant working order. The newer single-tube lamps cost only about $75 to $100 and only $750 a year to run, while Dr. Bang, of the Copenhagen Light Institute, has, it is said, just produced a new lamp with iron electrodes which costs but $15, and which can effect with 5 amperes what the Finsen lamp effected with 60 amperes in 1¼ hours.

In the Kjeldsen lamp one pole is of carbon and one of mercury, and it is claimed that this produces rich actinic rays.

The Finsen treatment has been found effective in cases of lupus vulgaris, lupus erythematosus, epithelioma cutaneum, acne, alopecia areta, erysipelas, various minor eruptions, and in rodent ulcers. Patients have been now under treatment for some years and in hardly any cases have the diseases made their reappearance.

Nowadays, so soon as the first stages of the disease are observed, the patient is placed under treatment, and the chances of complete cure are of course infinitely greater than if the disease has obtained a firm hold.

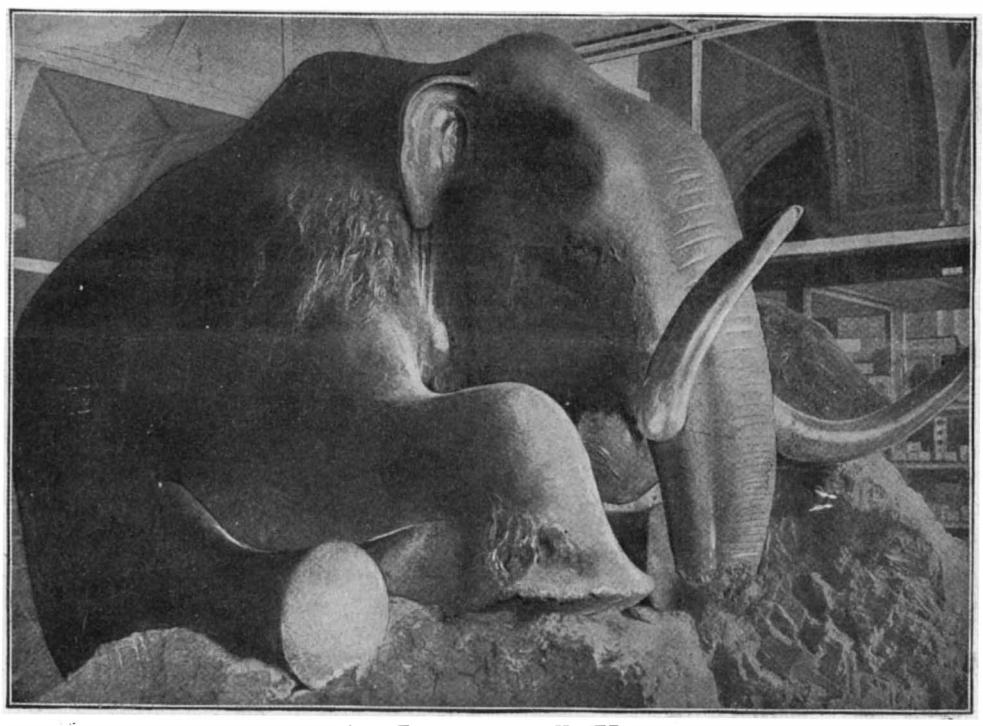
Since the invention of phototherapy and the recent improvements which have been made in the technique of the operations, there is no other form of tuberculosis which is easier to cure. The statistics which have been collected at the Finsen Institute from the end of 1895 to the first of 1902 relate to 804 cases, including all the patients afflicted with lupus who presented themselves at the institute. The number of patients who were entirely cured is 412; those whose cure is nearly complete with but slight traces of the malady, 192. The cases still under treatment number 117, of which 91 show an improvement and 26 remain about stationary. The treatment was interrupted for different reasons in 83 cases, by death or other grave malady 44, and for outside reasons 23, leaving but 16 whose treatment was stopped as being unsatisfactory. From the total of these results, it is shown that 695 cases out of 804 have been favorably influenced by the treatment, and many are cured entirely. But it must be remarked that many of these cases date from 30 to 50 years back, and of course are most difficult to cure. Dr. Finsen states that in the recent cases the cure is almost certain, and as the new cases are being treated as soon as they appear, it is expected that Denmark will soon be free from this malady.

A SIBERIAN MAMMOTH.

The huge body of the Siberian mammoth which was discovered in the summer of 1901 has now been erected in the museum of the Academy of Sciences at St. Petersburg, and is here illustrated for the first time. The unique interest of this discovery lies in the fact that though many fossil remains of mammoths have been found, and other preserved bodies of mammoths seen, no body so complete as this one has ever before been brought home to civilization. The hide, hair, eyes, flesh, and bones of the mammoth brought home by Dr. Otto Herz are all marvelously preserved by a set of circumstances similar to those which have given us the actual feathers of the extinct moa bird and the bony hide of the mylodon.

Dr. Herz describes the long hair and the thickness of hide of the mammoth, and how the stomach was found full of undigested food. The attitude in which he was found shows that he met his death by slipping on a slope, for his rear legs are bent up so that it would be impossible for him to raise himself. Dr. Herz writes:

"The impromptu grave into which the animal plunged was made of sand and clay, and his fall probably caused masses of neighboring soil to loosen and cover him completely. This happened in the late autumn, or at the beginning of the winter, to judge by the vegetable matter found in the stomach; at any rate, shortly afterward the grave became flooded, ice following. This completed the cold storage, still further augmented by vast accumulations of soil all round—a shell of ice hundreds of feet thick, inclosed by yards upon yards of soil that remain frozen for the greater part of the year. Thus the enormous carcass was preserved for how long no one knows, through hundreds of centuries perhaps, until not so many years ago some movement of the earth spat forth the fossil mausoleum, leaving it exposed to sun and wind until gradually, very gradually, the ice crust wore off and revealed to the passing Cossack the hidden treasure."



A PREHISTORIC MONSTER.

The mammoth whose actual appearance in the flesh has now been so marvelously preserved for us was known to early man, but appears to have died out completely before the advent of what are known as neolithic times. Thus his remains (teeth and bones) are found along with very old human remains of the early stone age, and a lifelike and unmistakable engraving of a mammoth has recently been discovered in the grotto of Combarelles, in France. How far early man assisted in the disappearance of the mammoth is not an easy matter accurately to determine.—The Sphere.

The report of the Uganda Railway Committee on the progress of the works for 1902-3 has just been issued. It states that, with the exception of a small tunnel and two other short deviations, the earthworks are finished, and that 27 large viaducts were erected during the year, the whole of the bridges and culverts for a distance of 948 miles having now been completed. The station buildings have been finished throughout the line. There are 43 stations, including Mombasa, the terminus at the coast, Port Florence, the terminus on the lake, the headquarters, and four other engine-changing stations. Coming to the rolling stock, the report states that 22 small locomotives, worn out by construction service, have been removed from the returns, together with 125 wooden material wagons. Eighteen engines have been fitted with automatic brakes, and they are being fitted to the whole of the passenger stock and a proportion of the goods vehicles.

Spectroscopical Determinations of Atomic Weights.

It has been known for some time that there is some connection between the spectrum lines of the elements and their atomic weights. This is shown, for instance, by a comparison of the spectra of alkali metals, in which the lines are found to approach the red of the spectrum for increasing atomic weights.

These relations form the subject of a paper by G. Runge read before the recent congress of German naturalists, held in Cassel. On closer investigation it is shown that each line of one element will correspond with a given line of another element, the structure of each spectrum thus being perfectly regular. When combining the lines by groups in so-called series, the same image is obtained for each element, any two images corresponding. This connection of the spectra, it is true, has not so far been possible for any groups of chemical elements. Wherever series are found, as for instance with Mg, Ca, Sr, Zn, Cd, Hg, Ai, In, Tl, Cu, Ag, Au, the series lines at least may be connected with one another. As regards the numerous remaining lines, impossible of being arranged in series, other criteria have to be resorted to in order to arrive at a connection from one element to another. Similar criteria are afforded by:

1. The aspect and behavior of the lines, which may be easily reversible, enlarged or well defined, the variation of the wave length under the influence of varying pressures, the luminous intensity at different temperatures in the Bunsen burner, the electric arc, the spark, in the case of self-inductions being inserted, etc.
2. The law of constant vibration differences.
3. The behavior of the line in the magnetic field.

If the different corresponding lines of a group of elements are found, the periods are a simple function of the square of the atomic weight, it being possible to determine either graphically or by means of empirical formulæ the atomic weight of an element from the atomic weights of related elements.

If the analytical form of this function were known, this method would afford a very accurate means of determining weights. For the corresponding line pairs of constant vibration differences, an empirical formula may be established, representing with a high degree of accuracy the distance of the two lines of a pair, in terms of the atomic weight. The distance within a group of chemically-related elements is, in fact, proportional to a certain power of the atomic weight, the logarithms being lineal functions of one another. This law has been applied by the author with the assistance of Mr. Precht to a determination of the atomic weight of *radium*, when the strongest radium lines were found to form pairs with constant distances. The lines, as shown by the author, will correspond according to the Zeeman effect with certain pairs in the spectra of Mg, Ca, Sr, Ba, the distance of the two lines of a pair increasing from one element to another along with the atomic weight. When plotting the distance in forms of the atomic weight, the value of the atomic weight of radium, as found by extrapolation, is 257, whereas Mme. Curie gives 225. The author thinks the substance used by the latter experimenter to have contained some barium, which would account for the high departures stated.—A. G.

The "Sleeping Sickness."

The British authorities in Uganda are making great efforts to discover the source of the terrible "sleeping sickness" which periodically decimates the natives of that territory and other parts of Africa, and, if possible, to find a means of preventing its spread. In May last year the Royal Society dispatched a commission to Entebbe, Uganda, for the purpose of investigating the disease, and early this year a second commission was sent from England for the same purpose.

The conclusions of the joint commission are now available through the publication of a progress report. This shows that the disease is caused by a minute parasite in the blood, which could not be conveyed from man to man. Consequently suspicion fell upon the tse-tse fly, a species of which, similar to the one prevalent in Zululand, was found abundant in Uganda, and experiments are now in progress to settle whether the Uganda tse-tse carries in its blood the identical parasite which is peculiar to the disease, and whether it can pass it to an animal.

One rather tentative experiment seems to show this, and it is expected that the truth or falsity of the theory will soon be determined.

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TRAPPING BIG GAME OF THE SEA.

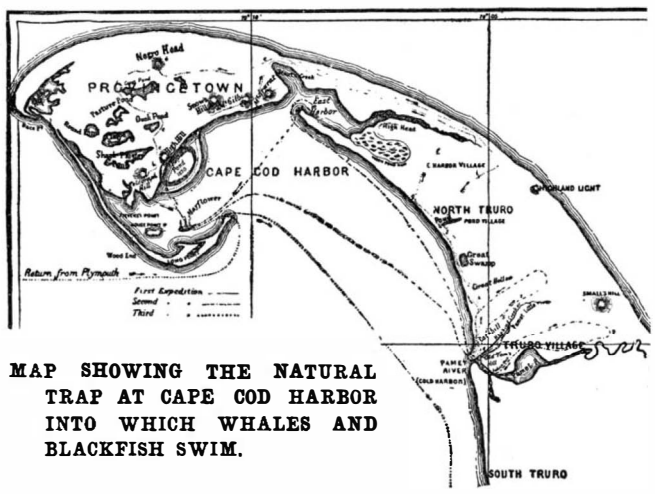
BY CHARLES F. HOLDER.

The relative intelligence of many large sea animals can be judged or tested to a certain extent by an examination of their methods of escaping from the various traps and devices set for their capture. On the northern coast of Norway and on some of the islands off this coast, the fishermen derive a large yearly harvest from the capture of whales of various kinds, which stray into the harbors. At certain localities where the bays are almost landlocked lofty stands are erected, similar to the otter outlooks on the North Pacific, and when a school is sighted, scores of boats put out, and by the very simple process of driving, hundreds of valuable oil-producing cetaceans are entrapped. The boats are formed in a line behind them, and by shouting, beating on the woodwork with clubs, and moving slowly in, the school or herd is completely demoralized, and finally driven high upon the beach.

The Faroe Islands are famous for this method of whaling, the so-called (locally) grind whale being popular game. One year a school of two hundred were caught at Tor Bay, and at Fetlar, one of the Shetland Islands, one hundred and ninety were taken in this simple manner, while a herd of five hundred was driven ashore by a crowd of boatmen in Uyea Sound in Unst. One of the largest catches ever made was in Hvalfiord, Iceland, where eleven hundred were driven ashore. The Mercury, a Scottish paper, thus describes a catch: "The little town of Stornaway was lately enlivened by a scene of the most animating and striking description. An immense shoal of whales was, early in the morning, chased to the mouth of the harbor by two fishing boats which had met them in the offing. This circumstance was immediately descried from the shore, and a host of boats, about thirty or forty in number, armed with every species of weapon, set off to join the others in pursuit, and engage in combat with these giants of the deep. The chase soon became one of bustle and anxiety on the part of both man and whale. The boats were arranged by their crews in the form of a crescent, in the fold of which the whales were collected and where they had to encounter tremendous showers of stones, splashings of oars, frequent gashes with harpoons and spears, while the din created by the shouts of the boats' crews and the multitude on shore was in itself sufficient to stupefy and stun the bottle-nosed foe to surrender. On more than one occasion, however, the floating phalanx was broken, and it required the greatest activity and tact ere the breach could be repaired and the fugitives regained. The shore was neared by degrees, the boats advancing and retreating by turns, till at length they succeeded in driving the captive monsters on the beach opposite the town and within a few yards of it. The movements of the whales were now violent, but except when one became unmanageable and enraged when harpooned, or his tail fixed in a noose, they were not dangerous to approach. In a few hours the whales were captured; the shore was strewn with the dead carcasses, while the sea presented a bloody and troubled aspect, giving evident proofs that it was with no small effort that they were subdued and made the property of man. On the present occasion, the whole inhabitants of the place, male and female, were interested spectators of the scene."

Such scenes are not uncommon in America, and in one of the accompanying photographs is shown a large school of blackfish which were captured in one of the best-arranged natural traps in this country—the little bay forming the harbor of Provincetown, Cape Cod. On the map the exact situation is seen. The blackfish or whales come down the coast from the north, encounter shallow water possibly to the east of Plymouth or midway the Cape, then follow it along, and are naturally led into the *cul de sac* of Cape Cod Harbor. Here the boats easily surround and drive the whales in. The large catch pictured created great excitement, even in a place where fishing is the order of the day and large catches are familiar to everyone. The school was sighted in the outer bay at North Truro at first, and a general alarm being given, every available boat and dory put out, the fleet easily placing itself in the rear, and while the blackfish were inside the point the actual charge began; men rowing, shouting, and screaming; some pounding the gunwales with oars; others striking the water, all crying at the top of their voices—a babel made up of Cape Cod, Portuguese, Swedish, and other tongues that doubtless filled the hearts of the blackfish with terror as they swam on and were literally driven upon the sands.

It was then that the most remarkable scene ensued. The boats pressed in from the bay, the occupants now striking the huge creatures with oars, harpoons, and lances, leaping overboard at the risk of their lives,



MAP SHOWING THE NATURAL TRAP AT CAPE COD HARBOR INTO WHICH WHALES AND BLACKFISH SWIM.

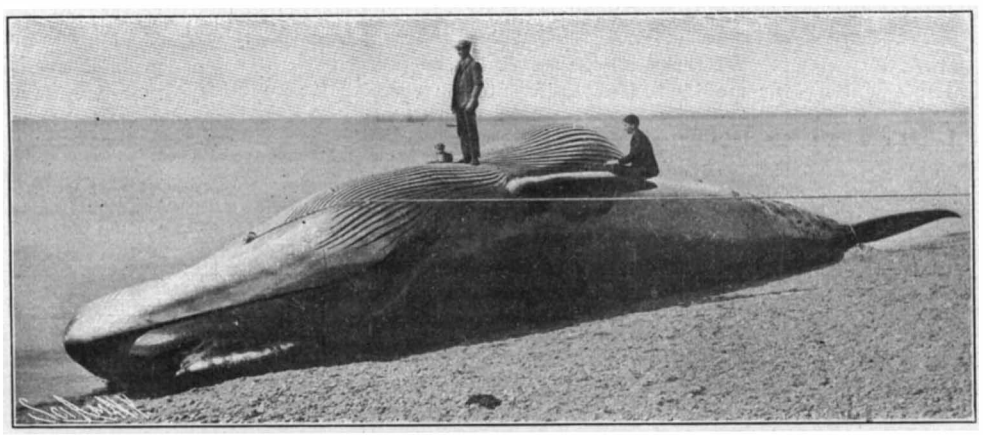
while down the beach came an army from the land from Truro and Provincetown, some in wagons, many on foot, others on horseback, armed with harpoons, guns, and even scythes. These joined the throng, and the remarkable sight was witnessed of cetaceans being lanced by men on horseback, the animals being driven out into the shallows, where for a few moments a scene of carnage was enacted that has few equals in the annals of blackfishing. Everyone was anxious to obtain a share, and various methods were devised to make legal claims. Some left their knives in the fish they claimed; others quickly cut their initials in the black hide, while the small members of a family whose head had killed several, mounted the bodies and defied all claimants.

At the end of the run the great beach and the shallows were strewn with the huge black and shapely forms of the fish which at a distance resembled small whales; and as the tide went out, the sand appeared to be covered with countless numbers, extending far down the shore and out into the bay. This windfall was a month's sensation on Cape Cod, and for weeks the fishermen along shore tried out the oil. It was estimated that between twenty and thirty thousand dollars was the net profit of the catch, divided among a large number of persons.

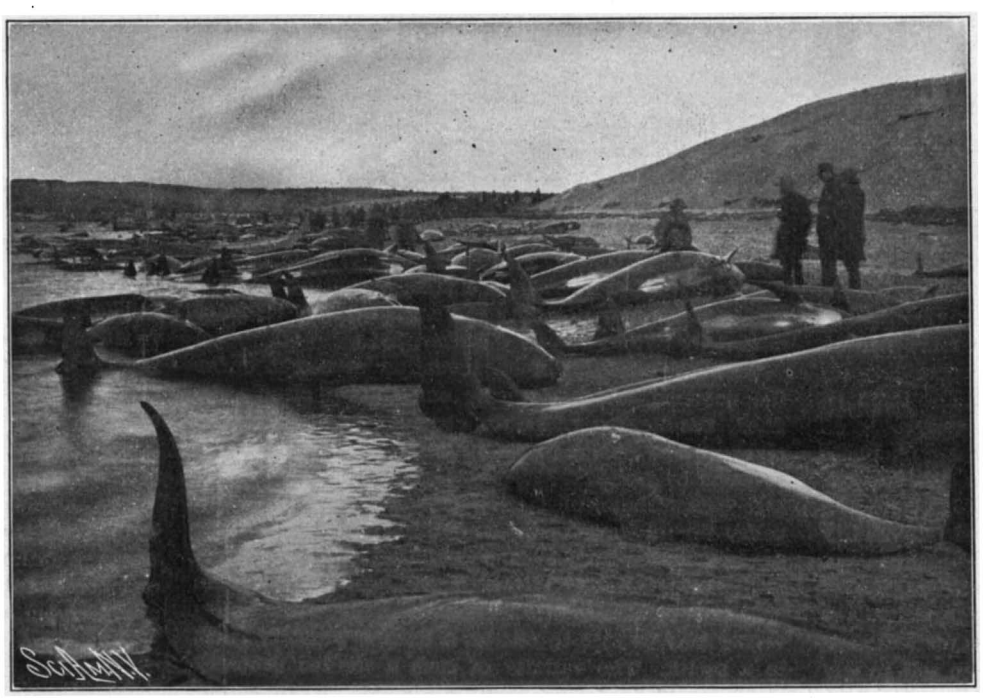
Larger game than the blackfish finds its way into this natural trap, as shown by the excellent photograph of a whale lying high above tide-water on the shore of the inner bay, Cape Cod. The victims to this trap wander inshore, encounter the arm of the Cape reaching out into the sea—one of the most remarkable results of currents in the world—and are led along into the bay. Many of the predaceous cetaceans chase food of various kinds inshore, and so become victims of their rapacity; but the large whales wander in. The one here shown was first observed at the entrance of the bay, and was driven in by attacks from the occupants of many boats. The whale made many efforts to regain deep water, displaying much intelligence; but it finally became confused and ran aground, where it was presently dispatched by the men, who secured it with ropes and hauled it in, so that at low tide it was entirely above water, where it was cut up and the valuable portions appropriated.

While Provincetown is a natural trap, its shores are lined with the peculiar nets of the local fishermen. These have the appearance of brush fences, which they are—literal runways leading the unsuspecting game into the inner toils of the skillfully-arranged net. The writer joined the owners of such a net in another locality, and when the net was lifted to the surface the variety of game was remarkable, including nearly every kind of fish found in adjacent waters. These nets at Cape Cod are frequently the means of taking giant horse mackerel. The latter swim into the harbor in schools after food, or are chased in by the orca—their inveterate enemy—and become entangled; and if they do not wreck the entire trap, they are often caught. This great fish doubtless is very cunning, as individuals have been known to enter a pound and devour its available contents, then escape to repeat the trick, to the consternation of the fisherman; but, as a rule, the large game becomes entangled and is captured.

On the coast of California, at the island of Santa Catalina, there is a singular fjord or deep harbor which has formed a trap for many large marine animals from cetaceans to sail-fishes. The cut is called Santa Catalina Harbor, and runs directly into the island, dividing a low mountain ridge, almost severing it; in fact, there is good reason to believe that at one time there were two islands, the intermediate space having been filled in, in the passage of time. This deep cut affords an interesting highway for large game, which is attacked by the fishermen who live in the vicinity, and easily caught. The writer has seen several large swordfishes which were entrapped here. The locality is particularly interesting from being the site of a herd of sea elephants, which were exterminated during the time of Scoresby in the early fifties.



FINBACK WHALE CAUGHT IN THE NATURAL TRAP AT PROVINCETOWN, CAPE COD.



BLACKFISH CAUGHT IN THE NATURAL TRAP AT PROVINCETOWN, CAPE COD.

The Value of Food to Life.

Prof. R. H. Chittenden, director of the Sheffield Scientific School, will co-operate with the Sheffield Laboratory in a physiological study of the minimum amount of proteid or albuminous food required for the maintenance of health and strength under ordinary conditions of life. In this study there are no special theories involved and no special systems of dietetics, but the object especially aimed at is to ascertain experimentally whether physiological economy in diet cannot be practised with distinct betterment to the body and without loss of strength and vigor. There is apparently no question that people ordinarily consume much more food than there is any real necessity for, and that this excess of food is in the long run detrimental to health and defeats the very objects aimed at. It is with a view to gather as many facts as possible on this subject that the study in question is undertaken.

Among the recent deaths noted is that of David Bell, pioneer ship and engine builder of Buffalo, N. Y. He was 85 years old at the time of his demise. He came to this country from Scotland in 1842, and in about twenty years had built one of the largest plants in this country at the time. In 1866 the works presided over by him achieved the notable distinction of turning out four locomotives which were then the largest in the world.

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Legal Notes.

THE PRIVILEGE OF LICENSORS AND LICENSEES.—Mr. P. A. Meyer's report on the privileges of licensors and licensees, submitted to the National Association of Implement and Vehicle Manufacturers, is well worth the consideration of inventors. We present herewith a summary of the report:

As to the trend of recent or modern decisions on the question of the power and right of patentees to regulate the prices and terms of sale of their patented articles, through and by their licensees, the federal courts have recently, in several judicial pronouncements, found and held that patentees have such right; that they may prescribe the price and lay down the terms of sale which their licensees shall charge and impose in selling to the general trade the patented articles covered by the patents under which the license is granted.

The Supreme Court of the United States in May, 1902, made such an announcement in the case of Bement vs. National Harrow Company, reported in volume 186, at page 70, United States Reports. In that case there was a license contract between the National Harrow Company, a New Jersey corporation, and a Michigan corporation. In this license, the licensee among other things agreed that it would not, during the continuance of the license, sell its products, manufactured under the license, at a less price or on more favorable terms of payment or delivery to purchasers than was set forth in a certain schedule, which was made part of the license. The licensee also agreed to pay the licensor, for each and every of the articles sold contrary to the strict provision of the license, the sum of five dollars as liquidated damages. The court said that the question was, whether or not such license contract was valid under the act of Congress approved July 2, 1890, Chapter 647 of the first session of the Fifty-first Congress.

Then the court said:

"On looking through these licenses we have been unable to find any conditions contained therein rendering the agreement void because of a violation of that act. There has been, as the referee finds, a large amount of litigation between the many parties claiming to own various patents covering these implements. Suits for infringement and for injunction had been frequent, and it was desirable to prevent them in the future. This execution of these contracts did in fact settle a large amount of litigation regarding the validity of many patents as found by the referee. This was a legitimate and desirable result in itself. The provision in regard to the price at which the licensee would sell the article manufactured under the license was also an appropriate and reasonable condition. It tended to keep up the price of the implements manufactured and sold, but that was only recognizing the nature of the property dealt in, and providing for its value so far as possible. This the parties were legally entitled to do. The owner of a patented article can, of course, charge such price as he may choose, and the owner of a patent may assign it or sell the right to manufacture and sell the article patented upon the condition that the assignee shall charge a certain amount for such article."

And as stating the rule of law on this subject, the court further said:

"The very object of these laws is monopoly, and the rule is with few exceptions that any conditions which are not in their very nature illegal with regard to this kind of property, imposed by the patentee and agreed to by the licensee for the right to manufacture or use or sell the article, will be upheld by the courts. The fact that the conditions in the contracts keep up the monopoly or fix prices does not render them illegal."

In June, 1902, in the District of Massachusetts, Judge Lowell decided the case of the Edison Phonograph Company vs. Pike, reported in Volume 116 Federal Reporter, at page 1863, in which he sustained the validity of a similar contract. The contract before him was one by which the owner of certain patents granted licenses to use and vend the patented articles, the licensees agreeing not to sell such articles for less than the price fixed by the licensor, and not to sell to any one who did not sign a similar agreement. The contract contained a further condition that as to any of the patented articles sold in violation of its terms, the license should be void, and that any vendor or user of such articles thereafter should be an infringer of the patents. The court held that such condition was valid and that the sale or use of the patented articles by one who purchased them from the licensee, with knowledge of the terms of the contract, and without signing the agreement required by the contract, constituted an infringement. Thus the court recognized the right of the patentees to impose the price at which the licensee shall sell the licensed articles, and the further right of the patentees to require the licensee not to sell to any one as his customer who will not sign a similar agreement. The point in the case was whether one who had purchased the patented articles of the licensee and had sold them in disregard of the terms of the license to the licensee, was an infringer. The court held that such customer so ignoring the terms of the license under which the licensee sold the goods to him, was an infringer.

In April, 1903, the Circuit Court of Appeals for the Seventh District, which sits in Chicago, decided the case of the Victor Talking Machine Company vs. The Fair, which case is reported in Volume 123 Federal Reporter, at page 424. In this case the court laid down the right of the patentee to fix the selling price of the licensed article in broad terms. The court decided that the "owner of a patent who manufactures and sells the patented article may reserve to himself, as an ungranted part of his monopoly, the right to fix and control the prices at which jobbers or dealers buying from him may sell to the public, and a dealer who buys from a jobber with knowledge of such reservation, and resells in violation of it, is an infringer of the patent."

Thus it may be affirmed that the time has been reached and passed in the progress of judicial pronouncement when a patentee or owner of a patent may lawfully regulate the price and terms of sale, both as between himself and a jobber or dealer, and between the latter and the public to whom they sell.

THE LEGAL STATUS OF TRADE SECRETS.—Under the common law as it prevailed in England and in the American colonies, it was a fundamental principle that when an invention or secret was divulged, it passed into the possession of the public. So absolute was the transfer of title, that the general use of the invention could not be restrained; and so broad was the rule, that a patent could not be granted after public knowledge of the secret had been obtained. Common law rules are never abrogated; they are only modified by statute to meet existing necessities. And so our own patent statutes are to be construed, not as abolishing a doctrine brought with them by our forefathers, but as a modern change. Under our latest patent statute, the common law rule that general knowledge of a secret or invention inalienably vests the right to that invention or secret in the people, has been so far modified that an inventor is permitted to publish his secret two years before applying for a patent. With the exception of this change, the common law right of the public to an unprotected secret which has come into possession remains unaltered.

Under this still-existing, slightly-modified principle, an invention is the property of its inventor so long as it has not come to the knowledge of others, and so long as it has not been patented. For the purpose of giving an inventor absolute dominion over his secret, and also of permitting the public under certain conditions to enjoy the fruit of the inventor's labor, our government has enacted patent laws, which restrict the common law right of the public and of other inventors to a secret divulged. "An inventor has no right to his invention at common law. He has no right of property in it originally. . . . If to-day you should invent an art, a process, or a machine, you have no right to hold that for seven, ten, fourteen, or any given number of years against one who should invent it to-morrow without any knowledge of your invention, and thus cut me and everybody else off from the right to do to-morrow what you have done to-day. There is no absolute right nor natural right at common law, that I, the original and first inventor to-day, have to prevent you and everybody else from inventing and using to-morrow or next day the same thing." (Holmes quoted by Shipley, J., in 4 Fisher, 284.)

With the position of an invention or secret under the common law and under our statute clearly defined, the next question to consider is what is the right of the public to an invention which has been revealed by fraud?

It cannot be denied that it is not against public policy for an inventor to divulge his secret to another for a consideration, on the condition that the secret shall not be further communicated. In so far as he may thus be able to sell an important invention, an inventor may be said to possess a limited property right in a secret. The validity of such a limited property right would be tested most thoroughly in an action in equity to restrain one from breaking a promise not to reveal a purchased secret. The English courts have discussed the question exhaustively; our own courts have followed in their footsteps. In the case of Bryson vs. Whitehead (1 Sim. and S., 74), it was deemed to be not against public policy to restrain the communication of a secret sold on condition that it should not be revealed. And in Yoratt vs. Winnyard (1 J. and W.) an injunction to restrain a defendant from communicating certain recipes for medicines and vending them was granted on the ground that he obtained a knowledge of the mode of preparing them by a breach of trust. It is essential that the inventor should have possession of a secret; otherwise an injunction will be denied. Thus, in Williams vs. Williams (3 Mer., 157) an injunction to compel a specific performance of an agreement not to divulge an important secret was dissolved on the defendant's denying the facts of the case, and on the ground that there was no secret. The distinction between public and private rights to a secret has been best drawn in the leading case of Morrison vs. Moat (9 Hare, 241), where it was held that a plaintiff not having the privilege of a patentee may have no title in the exclusive manufacture and sale of a medicine against the world, but he may notwithstanding have a good title against the particular defendant. In James vs. James (41 L. J. C., 351), the court likewise held that any person who, by fair means, has gained knowledge of a trade secret, may, after the death of the original inventor, continue the sale of the article; but he must not represent his as the only genuine article.

What are the rights of third persons in the matter of a secret developed? In the case of Morrison vs. Moat (*supra*) it was held that "a party may be enjoined from using a secret mode of compounding a medicine not protected by a patent, when he has acquired the knowledge by a breach of contract or fraud on the part of his informant."

As between two contractants it would, therefore, appear that publication of a secret can be restrained as the result of an action on the special contract. What should be the rule between employer and employe? If the employe specifically promises not to reveal the secret, it follows from what has already been said that he will be enjoined from breaking his promise. Thus in Peabody vs. Norfolk (98 Mass., 452), the complainant had built a mill and furnished it with machinery invented by him for manufacturing cloth by a secret process. An engineer in his employ, who had contracted not to give information concerning the machinery, but to preserve the process secret, was enjoined from violating his contract. A similar decision was rendered in Thun vs. Tloczynski (114 Mich., 149). Even without a special contract imposing secrecy, an employer can under certain conditions restrain a former employe from communicating a secret imparted to him during his employment; for if the employment is of a confidential nature, the promise not to reveal a secret will be implied (Salomon vs. Hertz, 40 N. J. E., 400; Little vs. Gallus, 4 Ap. Div., 569). But if no contract is either expressed or implied, one who has acquired knowledge of a secret may divulge that secret (Bell and B. Soap Company vs. Pretoria Manufacturing Company, Sup. Ct., 54 N. Y. Supp., 663).

The converse is also true. There is no reason why an employer to whom a secret may have been revealed under a special contract by an employe should not be restrained from breaking his contract if the employe should be discharged from his service. A court of equity will always consider the relations between the two parties and the nature of the agreement which has been drawn up by them or implied. Broadly stated, the rule would probably be that an injunction will be issued to restrain the use of a trade secret which has been acquired fraudulently or by a breach of trust.

Where a suit for infringement of a patent came on for hearing after the proofs had been closed, with an admission in open court as to the points in dispute, no claim being made against the complainant's title, such title is admitted, and cannot be thereafter questioned.

The effect of the words "substantially as described" in a claim of a patent is not to limit the claim to the precise construction shown in the specification, nor to deprive the patentee of the benefit of the doctrine of equivalents, where his invention is of a primary character.

The defense of anticipation is not made out where the alleged anticipatory process or machine is inoperative or a failure, while that of the patent is operative and successful, even though the same devices or parts are used, but combined in a new way.

An arrangement of parts in combination, so as to produce a new and useful result, shows invention, although such parts separately were well known and in common use, where such combination for the purpose intended was not obvious to persons of ordinary mechanical skill.

An assignee of a patent for an extended term is precluded by a license agreement, made by the patentee to induce the licensee to withdraw opposition to the extension, of which agreement it had knowledge, from maintaining a suit against such licensee for infringement.

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RECENTLY PATENTED INVENTIONS.

Electrical Devices.

PRINTING-TELEGRAPH RECEIVER. — J. D. WHITE, 50 Clanricarde Gardens, London, England. Mr. White's improvements relate to printing-telegraph receivers of the class which print the characters in successive lines across a sheet of paper, and the objects of his invention are to provide a simple mechanism by which the characters are printed successively across the sheet without either the type or the paper being moved laterally and also a means whereby at the end of each line the paper is moved up ready for the new line.

SAFETY TROLLEY-ALARM.—W. M. GRUNER and W. C. FINK, Springdale, Pa. The invention refers to safety trolley-alarms, an alarm on the car adapted to be sounded upon jumping of the trolley from the conductor-wire or breaking of the trolley-sheave through special devices or instrumentalities employing a local circuit with a special circuit-closer, the closer being adapted in its operation to simultaneously, through a special subtrolley, complete or restore the motor-circuit from the conductor-wire down through the car to ground or through metallic return.

ACCUMULATOR PLATE OR GRID.—J. VON DER POPPENBURG, Charlottenburg, near Berlin, Germany. The present invention relates to the manufacture of accumulator plates or grids of that kind in which the active material, together with the current-conductor imbedded in it is inclosed by a frame made of some non-conductor of electricity, as described in a former patent granted this inventor. As it is impossible to effect the mechanical connection between the frame and the current-conductor solely or chiefly by the active material or paste, this connection has been effected according to the aforesaid patent by means of cross-bars of non-conducting material, which gives support to the conductor in the frame.

ELECTRIC PUMP.—O. G. DOBERT, New York, N. Y. In this instance the invention relates to electric pumps, and the more particular object is to produce a type of electric motor and connections therefor so as to render the same suitable for operating a reciprocating pump. It may be used upon new machinery, but is also particularly adapted for service in supplanting steam machinery with electric machinery without disturbing a reciprocating pump already in use.

THERMOSTATIC POLE-CHANGER.—J. P. JENSEN, 37 Havnegade, Esbjerg, Denmark. The purpose of this improvement is to cause the sunbeams or the increase of temperature to influence an electric-contact arrangement in such a way that the direction of the current in a motor is shifted by sunshine or shadow. Hereby the motor is turned, respectively, in the one or the other direction, and this alternate movement is made use of in an appropriate manner

ELECTRIC BLOCK-SIGNAL.—W. S. JACKSON, Hoboken, N. J. This improvement relates to electric block-signaling systems especially adapted for use in connection with overhead electric railways, although essential parts of the invention may be used in connection with other kinds of systems. In the present invention Mr. Jackson aims to simplify and generally improve the system disclosed in a prior application for letters patent filed by him.

BLOCK-SIGNAL SYSTEM.—I. H. FRANCISCO, Rutland, Vt. While this inventor shows his system as applied to a double-track railway, he does not limit himself to double-track railways. Obviously by omitting certain duplicate parts the system can be used with single-track railways. With Mr. Francisco's system either the entire road or so much of it as is to be protected in the manner indicated is divided into blocks as usual.

Engineering Improvements.

EXPLOSIVE-ENGINE. — M. H. ROBERTS, Rolfe, Iowa. Mr. Roberts seeks to provide an engine adapted to operate under an explosive force of working agent of mixed air and gas or gasolene; and primarily seeks to provide an engine of this character capable of being operated under an economical use of the working agent and having its several parts co-operatively arranged to provide for a uniform and effective action.

DRAFT ATTACHMENT FOR LOCOMOTIVE BOILERS.—J. J. DE LANCEY, Binghamton, N. Y. The object in this case is to provide a draft attachment arranged for reversing the draft in the fire-box to permit of reducing the heat in the fire-box and extinguishing the fire therein in case of an emergency, such as the water falling below the safety-level or the injectors failing to work or other causes liable to produce an explosion of the boilers.

AUTOMATIC AIR-BRAKE.—C. H. NELSON, Trinidad, Col. In the present instance the invention has special reference to means for equalizing the release of air-pressure in the several brake-cylinders on the cars of a train, so that the brakes of the several cars may be applied simultaneously, also to means for equalizing the application or force of the several brakes of each car, and also to means for a quick release of air-pressure on the locomotive.

FEED-WATER HEATER.—R. B. BENHAM, JR,. Bland, New Mex. In carrying out the present invention the inventor has particularly in view arranging a coil or coils of pipes forming a feed-water heater in the front end of a locomotive-boiler a short distance from the flue-sheet, thereby allowing the hot air and gas from the fire-box to pass around the coils before escaping out through the stack, thereby heating the water in the coils before it passes into the boiler.

ROTARY ENGINE.—E. W. BULL, Cobourg, Canada. The object of the invention is to provide a new and improved rotary engine which is simple and durable in construction, readily reversed, and arranged to utilize the motive agent to the fullest advantage. This utilization is secured by the steam entering the cylinder acting simultaneously on the two piston-heads, so as to force the steam in opposite directions.

VALVE-GEAR FOR EXPLOSIVE-ENGINES.—W. J. MCVICKER, Rogers, Neb. In this patent the invention refers to improvements in gas or gasolene engines of the four-stroke cycle-compression type, the object being to provide means for operating the exhaust-valve by the explosion of gas or gasolene vapor in an auxiliary cylinder containing a movable piston, thus dispensing with gears, cams, eccentrics, etc., and to provide means by which the speed of the engine may be exclusively controlled by electricity.

ROTARY ENGINE.—M. D. KALBACH, Lebanon, Pa. The object in this case is to provide an improvement in that class of rotary engines which are operated by direct impact of a gaseous fluid, such as steam or air, the latter being worked expansively. The motive fluid is directed against radial blades of a rotary wheel, and the casing surrounding the latter is provided with a steam-passage which permits gradual expansion of fluid in passing from inlet port to exhaust. Valves govern the direction of the flow of motive-fluid, so that the engine may be reversed at will.

TRANSFER-BRIDGE.—A. H. MALLERY, New York, N. Y. An object in this improvement is the provision of a bridge so constructed and arranged that it will at all times practically maintain an even balance, and, further, to provide a simple means for securing the bridge to a boat or float whereby no torsional strain will be imparted to the bridge through the rocking motion of the float.

Hardware.

PERMUTATION-LOCK. — I. G. FRENCH, Orange, Mass. This lock is designed especially for application to the doors of residences, the arrangement being such that it may be readily opened from the inside of the house, but can only be opened from the outside by one familiar with the combination. The invention involves an arrangement whereby the lock may be operated in the dark to set the combination.

Household Utilities.

FOLDING BED.—C. P. BROWN, Springlake, Mich. In his present invention Mr. Brown seeks to provide means whereby metallic bedsteads of plain or ornamental design may be folded easily and quickly, such improvements being of a nature which enables him to fold or unfold the parts without modifying the factory or standard design of the head or foot sections of the bed or the angle-iron bed-frame of the spring.

PAN.—F. B. TUPPER and G. M. AUSTIN, North Berwick, Maine. In this patent the improvement refers to a pan intended especially for baking purposes, the article being formed of an integral sheet of metal, the side and end walls being bent up and engaged together in a certain manner, so as to provide ease of construction with a maximum degree of strength and durability.

Machines and Mechanical Devices.

SAW-COLLAR-TRUING MACHINE.—R. O. WIGLEY, Brewton, Ala. Collars which clamp and hold the circular saw upon mandrels sometimes get out of true. Turning off these collars to a true plane again is usually done by hand, but it is unsatisfactory. This invention provides a simple machine designed as an attachment to the sawmill husk or frame by which the work of truing the collars is conveniently, rapidly and accurately effected.

GEARING.—M. E. BACON and C. H. BACON, Flushing, Mich. This invention has reference to a gearing adapted especially for the driving of bicycles and by means of which the ratio of the gearing may be quickly and easily changed by the rider without leaving the saddle, thus enabling the gear to be changed at will to suit the conditions of the road over which the bicycle is being driven.

WIRE-WINDING MACHINE.—J. G. BAUER, Ravenna, Ohio. This machine is adapted for use in winding wire on carbon plates to produce brushes for use on electric motors or dynamos, although it may be used to wind wire on other articles. One object in view is to furnish a machine by which the wire may be coiled snugly and regularly around the work, provision being made for effecting a variation in the spacing of the coils of the wire.

RING AND TRAVELER FOR SPINNING-FRAMES.—Z. E. BOOTH, New Bedford, Mass. This invention provides a ring and traveler for use in spinning-frames and in twisting-frames arranged to insure an easy, free, and fast running of the traveler in the ring without causing undue friction of the working parts and without danger of injuring the yarn or thread and at the same time producing an even twisting of the fibers, thereby insuring the formation for an even, perfectly cylindrical yarn or thread and increasing the capacity of the machine. Mr. Booth has secured another patent on a ring and traveler for spinning frames wherein the invention insures the fast running of the traveler in the ring, at the same time increasing the capacity of the machine and causing an even twist of the fibers to produce a uniform cylindrical yarn or thread.

TUBE-EXPANDER.—C. B. CARTY, Washington, N. C. One of the leading features of this invention is the corrugation of the rollers, causing the rollers to make irregular and crossing indentations in the tube, thus facilitating the work of expanding it. The invention also relates to features of construction concerned with the other parts of the expander, which enable the action of the rollers to be rendered more thoroughly effective.

TRANSMISSION-GEAR. — W. W. ADAMS, Brockton, Mass. This apparatus comprises sets of gears having intermediate gears to transmit reversely. These gears, excepting the intermediate gear or gears, are mounted on two axes, and along one axis runs a shifting key acting with devices on the adjacent gears to render them fast or loose on their shaft. When a gear is made fast to the shaft, transmission is effected through this gear at a speed depending upon the ratio of the gear to its mate, and in direction depending upon the presence or absence of intermediate gear or equivalent means.

BED-PLATE FOR BALING PRESSES.—F. J. COAD and E. BIDDLE, Dallas, Ore. Much difficulty and expense are often encountered with many forms of baling-presses in use, due to the bearings and other elements thereof either spreading apart or getting out of alinement and which often results in the breaking out of teeth and other parts of cogs, racks, and pinions employed or causes such excessive binding as to render it very difficult to operate the press. The invention overcomes all these objections.

SANDING-MACHINE FOR MOLDS.—F. J. WILES, Stonypoint, N. Y. One of the principal objects of this invention is the provision of means for overcoming numerous disadvantages found to exist in many machines for molds for brick and the like, and to provide a machine of this kind which is effective and reliable in use, and comparatively inexpensive to manufacture. This machine will be easily controlled and regulated.

MACHINE FOR PRODUCING STEREOTYPE OR ELECTROTYPE MATRICES AND PRINTING-BLOCKS.—A. KRAUS, 10 Rue Marbeuf, Paris, France, and N. COLLINS, 2 Gray's Inn Road, London, England. This invention refers to a machine for composing type and producing therefrom a stereotype-matrix or a printing-surface, according as the type-faces are in relief or are sunk. It comprises a key-controlled rotary barrel, juxtaposed type-disks, and means of adjusting the type-disks and justifying the composed line of matter, also means for producing a matrix by the successive impression of successively-composed lines.

LOOM FOR WEAVING FIGURED DOUBLE-PILE FABRICS.—J. W. SMITH, Amsterdam, N. Y. This loom is adapted for weaving figured double pile fabrics, and especially the so-called "three-shot" velvet. By a novel arrangement of the jacquard apparatus and the harness threads, comparatively wide fabrics may be operated upon with a loom taking up a limited amount of floor space. Each design is made by two jacquard cylinders of different sizes mounted upon opposite sides of the needle mechanism. The loom has a large number of advantages.

APPARATUS FOR RESIZING, DECAPPING, AND RECAPPING CARTRIDGE-SHELLS.—E. L. WETSIG, Junction City, Kan. It is well known that shells once fired are not of the same size, and that it is desirable to reform or reshape shells once used in order to adapt them for reuse in the same gun. Mr. Wetsig's apparatus comprises fixed parts adapted to be secured to a wall or other fixed support and other parts adapted to slide on or in such parts, whereby shells may be resized and also decapped and recapped by a simple manipulation of parts.

OPERATING DEVICE FOR ELEVATOR-CARS.—P. F. FOLEY, New York, N. Y. One of the principal objects of this improvement which relates more especially to mechanical devices for raising and lowering the cars of elevators, is to provide means for overcoming many disadvantages found to exist with numerous other devices hitherto devised for similar purposes and also to provide devices of this kind which are exceedingly simple and inexpensive to manufacture and comprising few elements or parts, which are not easily broken nor liable to get out of order.

CENTER-GRINDER FOR LATHES.—T. H. COULTER, Brooklyn, Ohio. In this case the invention relates to that class of lathe attachments used for regrinding small projecting cones known as "centers." These centers from certain causes become untrue and have to be reground. Mr. Coulter's improvement comprehends the general features of other grinder devices, but provides a very simple and convenient construction which is quickly applied to any lathe and is so organized as to get a high speed and an effective grinding action.

LATHE ATTACHMENT.—J. W. BRONAUGH, JR., Manchester, Va. The attachment in this invention may be applied to any ordinary lathe and is adapted to be adjusted lengthwise and also transversely of the same. Longitudinal adjustment is effected by the ordinary feed-screw of the lathe or by its hand-ratchet, automatically or by hand. Transverse adjustment of the attachment proper is effected by the cross feed-screw of the lathe-carriage. The principal feature of the attachment is its inclination transversely of the lathe-bed.

COIN-CONTROLLED VENDING APPARATUS.—C. W. PLATT, Windfall, Indiana. The invention provides a casing for inclosing cigars and the several operative parts. Means are adapted to fully expose the revenue stamps on the box of cigars and also to expose the cigars in the box so that the operator can see them until all are discharged. Thus the last one sold is exposed prior to purchase. Access is had to the interior to open the machine to insert fresh cigars or remove coins. Through a coin passage a customer can see the coin fall until it enters the casing. Stamps are cancelled to comply with the revenue law.

Of Interest to Farmers.

HARVESTER.—E. A. CALLING, Brady, Neb. The invention has reference to harvesters, more definitely stated an improved attachment for reapers, headers, and other harvesting machines, having for its object to lift the fallen grain and carry it into the path of the cutting apparatus. Means are used to meet the requirements of the different kind or conditions of the grain.

POTATO-PLANTER.—F. E. SHAW, Evart, Mich. The purpose in this case is to provide a machine which when supplied with seed-potatoes will automatically drop the seed at suitable distances apart, whereby to properly space the hills, in connection with which machine a marker may or may not be used, and, further, to provide means for automatically opening a furrow and covering the seed dropped into it.

SOD-CUTTER.—J. M. HARLAN, Ardmore, Pa. When this machine is moved along, the annular cutters will form the longitudinal cuts, then the transverse cutting blade will go into operation to form the transverse cuts, after which the under cuts will be made by an undercutting blade, and thus the sod will be completely separated or released from the ground, and the series of sods will be all of the same dimensions.

CORN-SHOCKER.—T. L. CREATH, Mount Sterling, Ohio. In this patent the invention has reference to an apparatus adapted to be used in connection with a corn-harvester, the apparatus receiving the corn from the harvester and packing it into bundles ready for tying, after which operation the shock is deposited on the ground as the machine moves along the rows of corn.

KNOTTER.—J. E. FREIDINGER, Hastings, Neb. This device ties a knot which binds the gavel in a self-binding harvester. A rigid finger is provided in its outer end with a notch forming the separated side sections, one shorter than the other and sloped on its outer side at its end, and the longer section sloped at its end approximately in alinement with the sloped end of the shorter section, and a movable finger pivoted to the rigid finger and provided at its end with a hook working in the notch of the rigid finger and projecting below it in closed position of the pivoted finger.

Railways and Their Accessories.

LOCOMOTIVE-TENDER GATE. — H. O. MCCLAIN, Lincoln, Neb. The object in this instance is to provide a gate arranged to hold coal or other fuel in the pit in a proper position when the pit is filled, to allow the fireman to readily remove the coal from the pit, to permit of opening the gate and swinging it into a rearmost position at the time the coal gets low in the pit, and to permit the fireman to have access to the pit for the removal of the coal in the rear of the pit.

CONVERTIBLE PASSENGER-CAR. — A. KIMBLE, Zanesville, Ohio. This car is adapted to be changed from an open or summer car to a closed or winter car, or vice versa. The object of the invention is to provide such parts as will enable the conversion to be effected with economy of material and with dispatch. In other words, to employ a minimum number of parts which may be produced at small cost and to adopt such construction as will effect the change in short time and with little labor.

BRAKE-OPERATING MECHANISM FOR RAILWAY-CARS.—J. H. BRUCE, Pittsburg, Pa. In this instance the invention relates to brake-operating devices for railway-cars; and one of the principal objects is the provision of means for overcoming many disadvantages found in other devices, and to provide devices of this kind effective in use, besides comprising few parts, not liable to get out of order, easily regulated and controlled, and which will possess the capacity for long and repeated service.

RAILWAY.—S. E. JACKMAN, New York, N. Y. In this invention the improvement refers to railways such as are used for amusement in pleasure resorts, exhibitions, and the like; and its object is to provide a new and improved switch or inclined railway, arranged to take up comparatively little space, but affording a long and interesting ride. Another railway invention of Mr. Jackman relates to switchback or inclined gravity railways, used at resorts, etc., and its object is the provision of a railway having a continuous track for

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the cars to travel on and arranged to facilitate the entrance and exit of passengers and to afford them an exciting and interesting ride.

CAR-COUPLING.—S. E. JACKMAN, New York, N. Y. This case is a division of the application for former letters patent filed by Mr. Jackman. The invention relates to amusement devices, such as inclined or switch-back railways; and its object is to provide a coupler for convenient and safe coupling of the cars and arranged to prevent coupled cars from jumping forward off the track, especially when running over steep inclined portions in the track of the railway.

DEVICE FOR REPAIRING OR SPLICING RAILS.—O. D. BINETT, New York. It frequently happens that railway-rails become broken intermediate the ends of joints thereof due to various causes—as, for example, when subjected to undue lateral strains, exerted thereon by trains passing over the same, more especially in climates subject to rapid changes in temperature. This device may be quickly applied to the broken portion of the rail for the purpose of mending or splicing it, without the necessity of detaching the rail or any portion thereof.

LINE-PIPE COUPLING.—H. B. SCHRADER, Alliance, Neb. In this patent the invention has for its object the provision of an automatic coupling of simple and inexpensive construction having no sharp curves or loops in its ports to obstruct the passage of air or steam and in which air or steam pressure is utilized to cause a strict connection between the coupling members.

COUPLING FOR AIR-BRAKE HOSE.—A. F. ALLEN and J. F. LENHOFF, Wilmington, Del. The purpose of the invention is to provide a coupling which will act automatically in coupling and uncoupling, effecting a coupling the moment two cars similarly equipped are brought together and an uncoupling the instant one car is drawn from the other, thereby obviating the necessity of and consequent danger to an attendant employed to effect air-brake couplings between cars, besides securing a great saving of time.

AIR-BRAKE ATTACHMENT.—H. F. ONG, Wendling, Ore. In this invention the purpose is to provide a means acting as an auxiliary to the ordinary brake apparatus and serving automatically to apply the brakes should the car or train of cars begin to move and also acting automatically to release the brakes upon the proper action of the engineer or other trainman upon the ordinary brake apparatus.

Vehicles and Their Accessories.

RESILIENT CORE AND TIRE.—C. MILLER, Binghamton, N. Y. In this case the invention refers to cushion-tires of that character embodying an inner core and an outer shoe or casing, and the object is to provide for interlocking the core and the casing so as to prevent turning or torsional twisting of the core within the shoe or casing, and to provide improvements in the manner of clamping the shoe or casing upon the core and connecting the two members to the rim.

STEERING DEVICE.—C. EWING, Madras, India. This invention relates to rolling stock for single-rail tramways, such as shown in former letters patent granted to Mr. Ewing. The object is to provide a device for use on power-driven traction-engines, rolling-stock, and other vehicles traveling on single-rail tramways and arranged to steer the vehicle along the single rail without a steersman and to allow of running it with safety over the road at a very high rate of speed.

DEVICE FOR REMOVING VEHICLE-TIRES.—H. ATWATER, Vacaville, Cal. One of the principal objects of this improvement is to provide a device which shall be positive in operation, one wherein the vehicle-wheel will be tightly and firmly grasped while the tire is being removed therefrom and one wherein the clenching and forcing members or jaws will not be continually slipping or bending under the strain placed thereon.

WAGON-TOP.—J. POHLIG, New Orleans, La. This invention relates to improvements in wagon-tops and particularly to the manner of hanging and operating the curtains and apron thereof. In wagons of this type trouble and loss of time occur in adjusting curtains and they are often unevenly rolled. The object is to obviate these objections by so arranging the apron and curtains that they may be rolled or unrolled by a person standing within the wagon and so that when rolled they present a neat and smooth appearance.

PROPELLING DEVICE FOR VEHICLES.—J. P. LANGE, Passaic, N. J. The purpose of this invention is to furnish a propelling device for vehicles, which is arranged for quick and convenient attachment to an ordinary road-wagon, buggy, or like vehicle, the propelling machinery being separated and spaced from the vehicle for convenient access to the working parts.

VEHICLE-BRAKE MECHANISM.—O. MINTON, New York, N. Y. In Mr. Minton's patent the invention has reference particularly to improvements in brake mechanism for automobiles or motor-vehicles, and the object is the provision of a simple means to insure the cutting off of the steam or other motive agent upon applying the brake.

REVERSIBLY-CHANGED-SPEED DRIVING MECHANISM.—R. M. HEAD, Allegheny, Pa. The object of this inventor's improvements is to provide a mechanism whereby the motive power delivered to a secondary wheel or shaft revolving in a fixed unchanging direction may be automatically increased or diminished by merely reversing the direction in which the prime moving shaft, axle, or wheel rotates. It is applicable to bicycles, similarly-propelled vehicles, and other forms of utilizing or converting mechanical energy.

JACK.—W. W. DWIGANS, Arkadelphia, Ark. In the present case the invention refers to improvements in jacks for raising vehicle-axles or other loads, an object being to provide a jack of simple and light yet strong construction by means of which heavy loads may be lifted with comparatively little manual exertion and also to so construct the device that it may be conveniently carried under the seat.

Miscellaneous.

GLASS-BLOWING APPARATUS. — P. T. SIEVERT, Dresden, Germany. This apparatus is more especially designed for manufacturing glass articles such as vessels of cylindrical or other shapes and hollow glass bodies subsequently to be formed into sheet or window glass, the device being arranged to insure a proper distribution of the glass material to produce articles having walls of uniform thickness.

PROCESS OF MANUFACTURING HOLLOW GLASS ARTICLES.—P. T. SIEVERT, Dresden, Germany. The invention relates principally to improvements in a process for manufacturing hollow articles, from which sheet or window glass may be made, in which process the melted mass is spread upon a table, held firmly at its outer rim, preliminarily blown into a convenient shape in the open air or in a mold, and then blown out to any size, shape, and thickness, whether for the purpose of slitting and spreading the resulting hollow body into one or more sheets or for forming vessels of cylindrical or other shapes without such opening and spreading.

FOLDING BOX.—W. E. BURTON, New York, N. Y. The object of the present invention is to provide a folding box formed of a single blank and arranged to economize in the use of the material, to allow convenient and quick setting up of the box from the flat blank and to securely lock the integral parts in the set-up position. The invention relates to folding-boxes, such as shown and described in a former patent granted to Mr. Burton.

FOLDING HAT.—R. PLATO, New York, N. Y. In this instance the invention refers to outing-hats made of canvas or like fabric material; and its object is to provide a folding hat which is simple and durable in construction, cheap to manufacture, and arranged to allow of folding into a comparatively small space without danger of impairing the stiffness of the brim of the hat. The extended hat is not liable to wrinkle up and collapse.

WORK-BOX.—R. G. MCDOWELL, Anaconda, Mont. The principal object of this invention is the provision of a device by which a number of spools of sewing thread or silk may be detachedly or removably supported within easy reach of a seamstress while at work, thereby overcoming many annoyances and loss of time, and also enabling suitable lengths of different colored threads or silks to be drawn from the spools accordingly as required.

POCKET MATCH-SAFE.—E. J. MOORE, New York, N. Y. This contrivance is especially adapted for carrying "safety-matches." The panel upon which the matches are to be struck is protected effectually when not in use, and therefore cannot be damaged by moisture or by pocket wear, and the means for protecting such panels are simple and readily applied and can be conveniently and quickly operated. The material over which matches are drawn may be readily replaced when unduly worn.

SAFETY-GUARD FOR RAZORS.—A. A. LUX, St. Paul, Minn. In this improvement the object is to provide details of construction for an attachable guard which may be applied upon any razor-blade of ordinary form, be adjustable with regard to the cutting edge of the razor, be light, shapely, convenient to place and remove, and that will effectively protect the face from injury while the razor is used freely.

RAZOR AND GUARD.—J. H. HILTON, New York, N. Y. The aim of this inventor is to provide a new and improved razor and guard arranged to permit convenient adjustment of the guard relative to the cutting edge of the blade and to allow removal of the blade when worn down too far for the guard to be effective and the substitution of a new blade for the worn-out one.

SCENIC APPARATUS.—W. A. HADDEN, New York, N. Y. In this device a series of pictures arranged in various attitudes gives the illusion of movement when consecutively and rapidly brought before the vision; an object is to provide a device in which the pictures are stationary, while the illusion of movement is given to a person while rapidly passing along the series of illustrations in a railway-car, particularly in a subway or tunnel.

TURPENTINE-POCKET.—A. G. GEIGER, Congaree Township, S. C. This may be classified as an improvement in devices adapted for attachment to the trees below the incision formed and adapted for catching the liquid. The device is fitted by form and construction to be attached to a trunk by driving it into the bark so that it stands inclined outwardly and upwardly, and thus constitutes the outer side of a pocket for the turpentine.

NON-REFILLABLE BOTTLE.—H. A. CLINTON, Newark, N. J. The purpose of the invention is to provide a simple and economic form of device adapted to be firmly secured to the neck of any ordinary bottle, which device is so constructed as to admit of liquid being freely poured out from the bottle, but which will prevent the bottle from being refilled and offered a second time as an original package.

BEATING OR WHISKING DEVICE.—W. R. CAIN and N. B. CAIN, Port Jervis, N. Y. In this patent the improvement has reference to means for rapidly rotating various objects, such as the beater-plate of an egg-beater or the brush of a chimney or bottle cleaner. It comprises a certain arrangement of a spiral and sliding agitator by means of which a rapid rotation is imparted to the beater or brush.

SAFETY HOISTING-HOOK.—J. M. WAID, Colebrook, Ohio. This invention refers to hooks for hoisting buckets and other articles. It consists of a special hook and peculiar safety-catch with novel locking-dogs, and among its advantages may be mentioned the fact that in any position of the hook the dog and engaged member will remain locked; and, also the form of the catch, which is formed so that should the hook in use contact a beam or other structure, the curved outer edge of the catch device would ride it free from holding engagement with the beam or other structure.

ADDING REGISTER.—H. G. WHITE, Waverly, Mo. The register comprises a rotatable disk mounted between two fixed disks. The rotatable disk is provided with twenty consecutively numbered teeth which may be singly seen through a notch in the fixed disks. Another circle of figures ranging from 21 to 40 appears through an opening in the front disk. In operation the figures are added by tens and each ten is registered by moving a tooth so that only the addition of units need be mentally done. An intermediate circle of figures provides for adding by twenties.

DEVICE FOR OPENING BUCKLES.—G. F. CAREY, New York, N. Y. The purpose of the invention is to provide an attachment to the tongues of buckles whereby the latter may be quickly opened with gloved hands and in cold weather when the fingers are more or less numb, and whereby, further, the billet-strap may be released from the buckle at any time in a convenient and quick manner without touching the tongue of the buckle.

COMBINED WAIST-BRACE AND BELT-HOLDER. — CAROLINE BREMER, Davenport, Iowa. Specifically stated, the invention consists of an elongated metal plate having peculiar fastening and belt-holding means adapted to provide a bracing-support to the waist, compelling the wearer to walk in straight, erect position, and thereby giving neatness to the figure of the wearer in front and back. Means are included for holding down the waist and skirt belt in front.

DISPATCH-BOMB. — H. B. LITTLEPAGE, Washington, D. C. The bomb may be fired in a high trajectory and carry a message over an enemy's lines. It will be useful in many ways. Thus, in ordering in reserves at a certain point, it can be done almost instantaneously and the exact point given without fear of interception. The invention will be valuable when the army and navy are co-operating and useful for ships of war or commerce in communicating with the shore or life-saving stations.

GUARD AND MIRROR FOR WATER-GAGES.—R. S. MEARS, Topeka, Kan. The intention in this case is to provide a novel simple guard and mirror which will prevent injury from flying glass to a person near the water-gage if the tube is suddenly burst by pressure of steam and which also by reflection of the mirror will clearly display the contents of the intact tube for inspection to readily note the level of water in the gage and boiler.

CIGAR-BAND.—L. M. WEILLER, New York, N. Y. In this instance the object is to removably secure a match to a cigar or other like articles by means of an encircling band. Any suitable match may be used in connection with Mr. Weiller's invention, but he contemplates the use of "safety-matches," since in their manufacture no ingredient is employed which affects the cigar, and he therefore provides a striking-surface upon the band, upon which the match may be ignited.

DOUBLE-ACTING COMBINATION-LOCK VALVE FOR BARRELS, ETC.—W. H. BAKER, New York, N. Y. In this patent the invention has reference to double-acting combination-lock valves for use particularly upon receptacles, such as barrels, etc., the idea being not only to prevent the contents of the receptacle from being removed by unauthorized persons, but also to prevent the removal of the valve itself from the receptacle.

APPARATUS FOR LOADING VESSELS.—C. J. INGARD, Port Townsend, Wash. This invention relates to improvements in apparatus for loading lumber, timber, or other material of a heavy nature on vessels, and the object in view is the provision of a device of this character by means of which the lumber, timber, or other material may be rapidly placed on a vessel, thus resulting in great economy of loading.

NOSE-PIECE FOR EYEGLASSES.—W. F. KORNEMANN, New York, N. Y. In the present patent the invention has reference to improvements in nose-pieces for eyeglasses, an object being to furnish a nose piece of simple construction that may be readily adjusted to a person's nose and that will bear lightly on various points on the nose without slipping or pinching.

RIDING-HABIT.—A. LOSCALZO, New York, N. Y. In this skirt a pocket is formed for the pommel, as heretofore; but the seams are so disposed that the pocket constitutes the sole irregularity in the skirt, and when the leg is thrown over the pommel the latter is received in the pocket and the skirt hangs gracefully and smoothly from the wearer's waist and pommel-leg. The improvement does not interfere with the perfect ease of the wearer.

DUST-GUARD.—J. MALTRY, Omaha, Neb. The present application is a division of a former application of Mr. Maltry. The invention comprises the combination, with the inner open end of the oil-box, of two peculiarly-arranged collars spaced by a ring and held yieldingly against the oil-box by means of spring-pressed rods which are engaged with the axle-box in a peculiar manner.

SHIRT-WAIST AND SKIRT SUPPORTER.—ALVAH WILTSEY, New York, N. Y. The purpose in this case is to provide a device adapted for holding a shirt-waist in position at the waist-line of the wearer and likewise the waist-band to the skirt, preventing the former from riding up and the latter from dropping down. The device can be conveniently held in position and manipulated so that a belt can be connected therewith, which belt when tightened will automatically cause the clamping members to fasten upon and hold the parts introduced without damage to the parts.

LIGHT-EXCLUDING ATTACHMENT FOR CAMERA-PLATE HOLDERS.—R. A. BACON, New York, N. Y. Many artistic and valuable pictures are ruined through a ray of light striking the plate at the instant the dark slide is withdrawn from the plate-holder. The object in this invention is to overcome this difficulty by providing an attachment which will be extremely simple and economic in its construction and one which may be readily used in a camera or a plate holder in such manner as to effectively exclude every ray of light.

COLLAR-FASTENING.—J. W. ALEXANDER, New York, N. Y. This device fastens the front portion of a shirt-neckband and attaches a collar thereto. It often happens that one or both of the buttonholes at the front of a shirt-neckband become broken out or so enlarged that an ordinary collar button cannot be used. The object is to provide a fastening device that may be readily attached to a neckband having a broken buttonhole, holding the ends of the band together and also the ends of the collar.

SNATCH-BLOCK.—F. M. EBY, Cottage-grove, Ore. In this patent the invention consists in certain novel constructions and combinations of parts, and is an improvement in snatch-blocks, particularly in that class of snatch-blocks which are designed to open by displacement of one of the side plates of the block-frame.

COAT-STAY.—C. RICHMAN, New York, N. Y. The main object in this case is to provide a permanent stay for use within a coat between the cloth and linings to prevent the front portions of the coat from wrinkling when unbuttoned, as is often the result when there is no such support; and a further object is to so improve the shape and construction of the stay that it is better adapted than others of its class to fit a person's chest and shoulder.

STEAM-TRAP.—R. D. TACKABERRY, Lewiston, Me. The invention is adapted particularly to the entire removal of the water of condensation from the drying cans or cylinders used in cotton mills, bleacheries, paper-mills, etc., although its application is not confined to this particular use. Heretofore devices have failed to draw off the entire or any more than approximately one-half of the water which accumulates.

CIGAR-CASE.—W. W. PUGH, Washington, D. C. The present invention refers to an improvement in that class of cases or boxes for holding cigars or cigarettes which are adapted to be carried in the pocket and to be so manipulated that an inner slidable box or case containing the cigars may be projected when it is desired to select or remove a cigar or cigarette. The contrivance may be conveniently used for holding various other articles.

SNATCH-BLOCK.—D. E. WELSH, Cottage-grove, Ore. Mr. Welsh's invention has for an object the provision of an automatic trip whereby the hauling line or other object being hauled approaches the block to permit the log to pass the block, thus obviating the necessity of a signalman at each block and the stoppage of the engine, as is usual under the present condition for the release of an ordinary snatch-block.

HAMES AND HORSE-COLLAR.—R. J. HORCHKISS, Pepacton, N. Y. The object of the improvement is to provide a collar which will distribute the draft strain it sustains over a considerable area of the breast and shoulders of the animal, so as to enable the animal to draw a heavy load without galling the shoulders, a further object being to so combine a pair of hames with the collar that they will afford support thereto by holding the

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parts of the collar in positions to receive the strains of pulling the load without imposing such strains upon the hames.

WELL-ROD EXTRACTOR.—W. W. FRENCH, Vanderbilt, Mich. In this patent the invention consists in the novel construction and arrangement of a clutch device, and the object of the inventor is the provision of a simple and practical apparatus for extracting from well-casings the working rod whenever it becomes broken or uncoupled at a point low down in the well.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

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Evaporation, Box 773, New York. Party who advertised as above, on March 14 last is requested to call at this office for a reply to advertisement.

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Inquiry No. 4228.—For manufacturers of slot machines.

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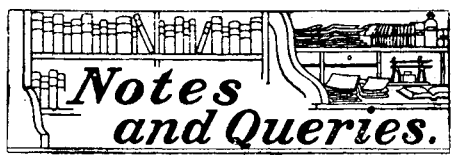

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(9228) R. E. W. says: In the SCIENTIFIC AMERICAN of June 13, 1903, page 444, is an article regarding the Parsons turbine as an air compressor. Can you give me formula for computing volume and pressure of air compressed by this method? I wish to build an experimental machine, but can find no data on the subject, such as inclination and number of vanes and variation of pressure with variation of speed. A. The principle on which the Parsons turbine, when used as an air compressor, acts is similar to that of the ordinary revolving disk fans, such as are commonly used to keep the air circulating in offices and restaurants. These fans act exactly as the screw-propeller of a boat does; the velocity and volume of the air current produced depending upon the size and the angle of the vanes, and the number of revolutions per minute which the fan makes. If you will imagine such a fan placed inside a pipe approximately equal to its own diameter, you can readily see that if there were no slippage between the air and the fan, the quantity of air moved per minute would equal the area of the fan times the pitch of the blades times the number of revolutions made per minute. From this you can easily determine the velocity of the air current. The pressure against which such a fan may work is proportional to the square of this maximum velocity. There is, however, always a certain percentage of slippage, so that the volume of air and its velocity, as determined above, must be multiplied by a certain coefficient. The value of this coefficient depends entirely upon the size and number of the vanes, their pitch or angle, and the speed at which they are run. Unfortunately there are no experimental data to cover the case of the Parsons turbine, and the speed, size, and angle of the vanes here will be so different from the conditions of the ordinary ventilating practice that it is almost impossible to predict what coefficients should be used. The effect of the several rows of blades on the Parsons turbine, if the different rows of blades are all set at the same angle, would be simply to reduce the slippage, and to thus make possible the use of a very much higher pitch—producing a correspondingly greater velocity or pressure of the air current—than would be otherwise admissible. We trust that this explanation will be of service to you in directing the experiments which you are about to make, and we regret that there are no more definite data that we can send you as a guide.

(9229) W. R. writes: Your answer to W. E. H. (9107), July 25, states that only the force of gravity by falling weights, or I might add, a wound-up spring or springs when uncoiling, would give him the motor or power he is in search of. He objects to the aid of steam, water, electricity, etc., but only wants a mechanical power, such as wedges, inclined planes, or levers. Surely, he must know that no power could be given out from these agents unless a power had been applied to them. For his information, I would state that instead of springs or weights for driving clocks, or carriages, or phonographs, he can erect an overshot waterwheel (although he objects to water) to drive a clock perpetually, not by perpetual motion, which I see he has the sense to know is humbug, but by keeping the buckets full, with the rain or water from the mains. I erected one a year ago, and it has been going ever since and keeping splendid time, and will go on forever till it falls to pieces or rain stops falling.

(9230) M. L. says: How would I determine the foci of an ellipse, the diameters as 9 inches by 7½ inches being given? Would like a definite rule by which I could describe the ellipse. A. To determine the foci of an ellipse, when the axes are known, draw lines at right angles to each other and lay off the semi-axes from their points of intersection. From one extremity of the shorter axis as a center, with a radius equal to half the longer axis, describe an arc cutting the longer axis in two points. These points are the two foci. An ellipse is most easily and accurately described by drawing the two axes as above, and setting a pin at the two foci and at the extremity of the minor or shorter axis. Then tie a fine cord, which does not easily stretch, around the three pins, forming a triangle. Now remove the pin at the extremity of the minor axis, and with a pencil having a sharp point, take the thread on the point of the pencil where the pin has been removed. Now draw the curve, keeping the thread at a uniform tension. The loop of thread slips around the pins which are at the two foci, and each point of the curve obeys the definition of an ellipse, which is: "A curve each point of which has the sum of its distances from two fixed points a constant quantity." This constant quantity is the major axis.

(9231) H. F. says: I have had a curious experience with watches that I am at a loss to explain, and should be glad to know whether there is any reason why a watch might keep good time when carried by one person and be wholly unreliable when carried by another, under apparently the same conditions. My first watch had been in use a good many years when it came into my possession. After some time, about half of which the watch was in the repair shop, I concluded that it was worn out, and bought a new one with as good works as I could get. This watch kept accurate time for two or three days, or even a week at a time, then it became very irregular. It was as likely to be one time of day as any other. I reset it several times, and then took it back for regulation. This experience I kept repeating for six months, the jeweler meanwhile declaring that the watch kept good time so long as it remained with him, and I fancy, suspecting that I did not keep it wound. At last, however, he took the watch and gave me another, which behaved precisely the same way. It may sometimes have run two weeks accurately, but very seldom more than two or three days. As an investigating experiment, I exchanged watches with a friend who had a perfect timekeeper. My watch was carried six weeks by this person, keeping accurate time during that period. In the meantime, the watch I borrowed lost time regularly, at the rate of half an hour in three or four days. This watch during the six weeks never behaved quite as erratically as mine, but it never kept good time while I carried it. I now have my own third watch, and am never able to keep it going more than a few days without finding it one, two, or three hours behind time. It must stop and start again, for it could not lose so much in so short a time, though it is always going when I examine it. I think it starts with the movement of looking at it. Since this experience my first watch has proved a satisfactory timekeeper in other hands. I inquired of a watchmaker, who assured me that there is a great difference in people in their capacity to carry watches and have them keep good time. He attributed it to the difference in the movements of the different people. This does not seem a plausible explanation, and if true, would not be satisfactory in this case, for my movements are less active than those of the person who carried my watch. I have met two people who claim that they have never been able to carry a watch, and have given it up. I am curious to know if there is any reason why I or any one should not be able to carry a watch, the watch being in good condition and kept wound, and if there be any cause, what it is. Can you give me any advice in regard to the matter? A. We have referred your statement regarding the change in the rate of a watch when different people carry it, to a wholesale dealer in watches in this city, and his reply is to the effect that it is not proved that the carriage of the person can affect the running of a watch. The difference in the stepping of one person and another is not sufficient to change the running of a watch appreciably, certainly not to the extent which you describe. The irregularity you ascribe to the watches is, by this good authority, considered to be due to the treatment of the watch in service. This is, in his opinion, irregularity in the time of winding as the most important; laying it down at night in different positions, sometimes on its back and sometimes on its face, and sometimes hanging it up in the pocket. These things make any watch irregular, no matter how good the watch may be.

NEW BOOKS, ETC.

THE PRACTICAL PHYSICS OF THE MODERN STEAM BOILER. By F. J. Rowan, A.M.I.C.E., M.I.E.S. Preface by R. H. Thurston. New York: D. Van Nostrand Company. 1903. 8vo. Pp. 638. Price $7.50.

The work is admirably illustrated by 314 engravings and describes the best modern practice. The literature on the mechanics of the steam boiler, such as the strength of materials, etc., is voluminous, so the present author has endeavored to take another path, as guided by the indications of physical research, toward the goal of a fuller understanding of the action involved in steam raising and of the requirements of efficient boilers.

ACETYLENE: THE PRINCIPLES OF ITS GENERATION AND USE. By F. H. Leeds, F.I.C., F.C.S., and W. J. Atkinson Butterfield, F.I.C., F.C.S. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company. 1903. 12mo. Pp. 276. Price $2.

The literature concerning acetylene is limited, so that a work of this kind is welcome. The author deals with the cost and advantages of acetylene lighting, the physics and chemistry of the reaction between carbide and water, the general principle of acetylene generation, selection of a generator, and the subsequent treatment of the gas, subsidiary apparatus, mains and service pipes, combustion of acetylene, incandescent burners, compressed and dissolved acetylene, the valuation and analysis of carbide.

SPRAYING CROPS: WHY, WHEN, AND HOW. By Clarence M. Weed, D.Sc. New York: Orange Judd Company. 1903. 16mo. Pp. 136. Price 50 cents.

This little manual has been prepared for the purpose of aiding owners of spraying machines to use them to the best advantage. The practical results of the most recent investigations and experiments have been embodied in it. The development of the practice of spraying crops furnishes a striking illustration of the practical results agriculture may derive from scientific investigation and accurate experimentation. The present is the fourth revised, rewritten, and enlarged edition.

ETAT ACTUEL DU LABOURAGE ELECTRIQUE. Par Emile Guarini. Paris: Publications du Journal Le Genie Civil. 1903. Pp. 16.

In this paper, which is a reprint from Le Genie Civil, Emile Guarini, well known to the readers of this journal as a contributor, very thoroughly examines the use of electricity in agriculture and shows just what the commercial possibilities of a system of electrical plowing are, basing his conclusions upon experiments actually carried out.

DIE EISENKONSTRUKTIONEN DER INGENIEUR-HOCHBAUTEN. Ein Lehrbuch zum Gebrauche an Technischen Hochschulen und in der Praxis. Von Max Foerster. Ergänzungsband zum Handbuche der Ingenieurwissenschaften. Leipzig: Verlag von Wilhelm Engelmann. 1903. Pp. 544. Price $12.50.

This is the second edition of a book which it was our pleasure to comment upon about a year ago. In that brief space of time the work has met with such marked success that a second edition has already become necessary. Naturally, the changes which have been made in civil engineering have not been so marked that a revision was at all necessary. The author has, therefore, confined his attention to a careful editing of certain of the sections, notably those treating of the behavior of iron structures when subjected to heat, forged iron columns, anchorages, and particularly those sections which treat of strains. The Hennebique process is now fully described, and also Mohrsch's calculation methods. The bibliography has been increased by the addition of references to articles in books which have appeared since the publication of the first edition. Additional figures are also to be found in the book. On the whole, the improvements which have been made have added to the excellence of a book, which should be of great value to the practitioner as well as to the student.

THE ART OF PATTERN MAKING. By I. McKim Chase, M.E. New York: John Wiley & Sons. 1903. 12mo. Pp. 254, 215 figures. Price $2.50.

A good book on pattern making is always welcome, and the volume before us will prove specially valuable to those who have occasion to make patterns for such objects as screw propellers, cylinders for marine engines, etc. The book will be of special value to students in technical and manual training schools. It is a book which we can heartily commend.

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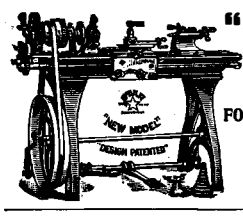

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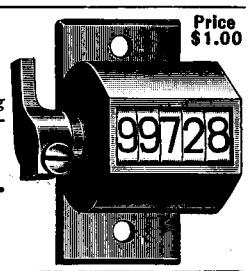

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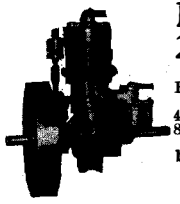

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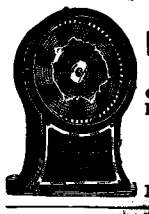

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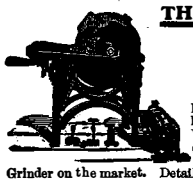

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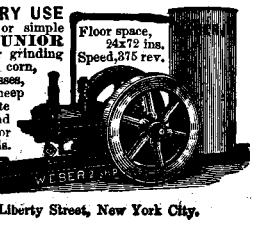

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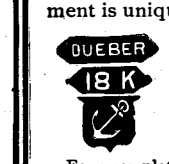

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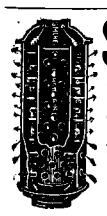

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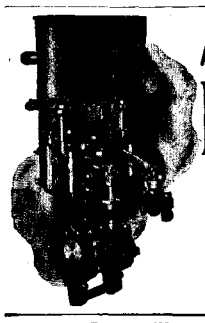

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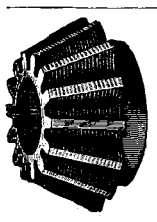

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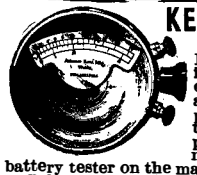

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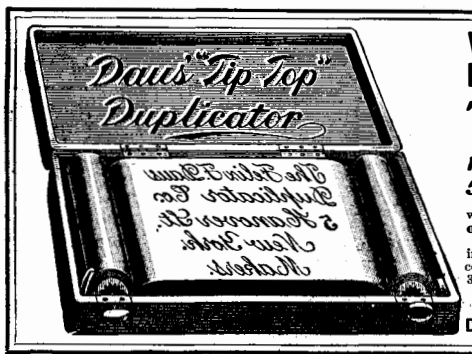

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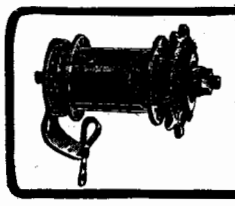

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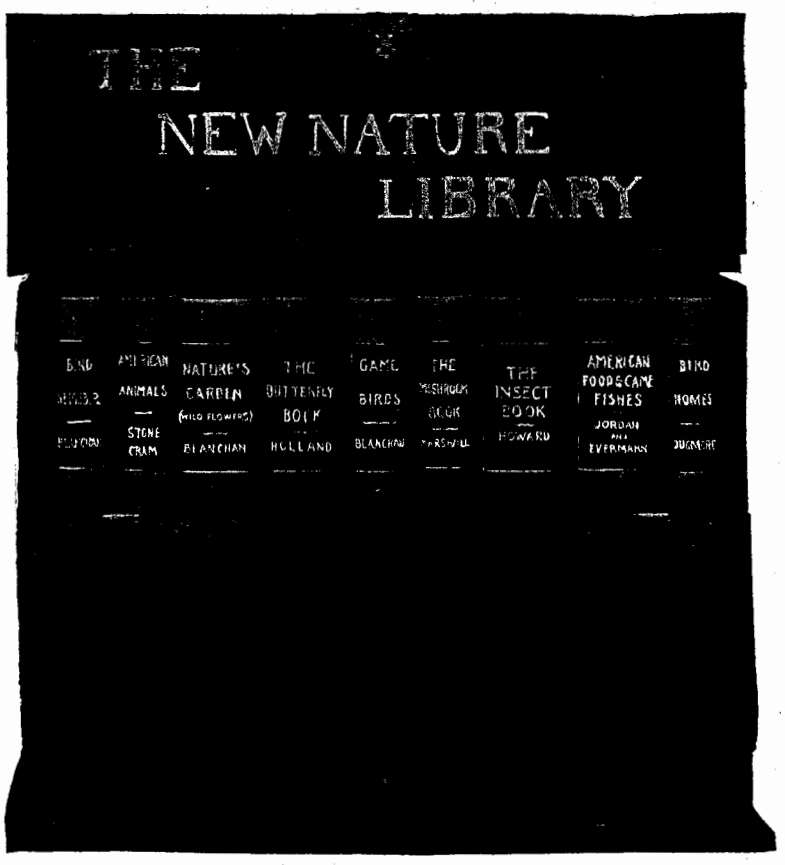

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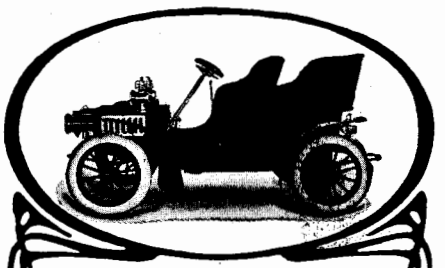

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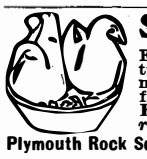

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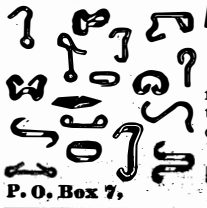

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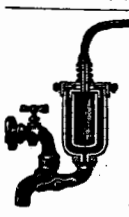

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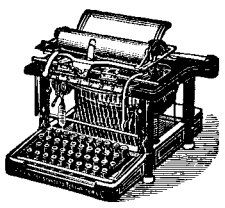

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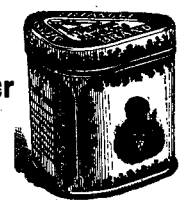

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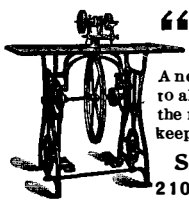

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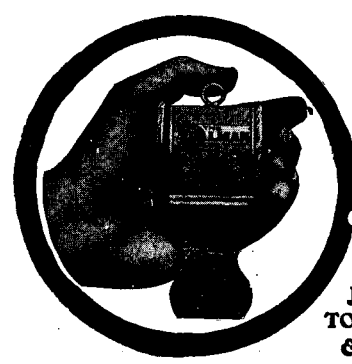

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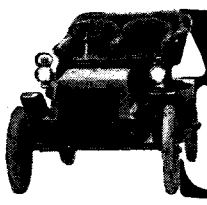

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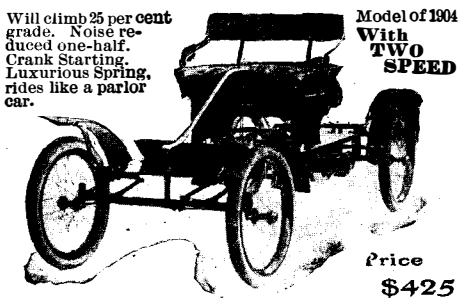

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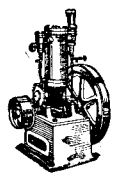

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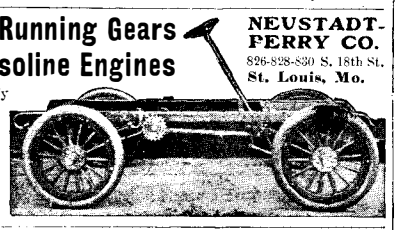

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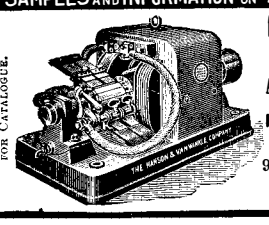

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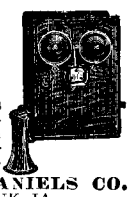

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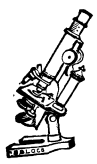

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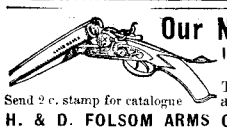

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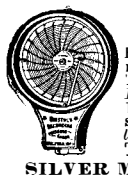

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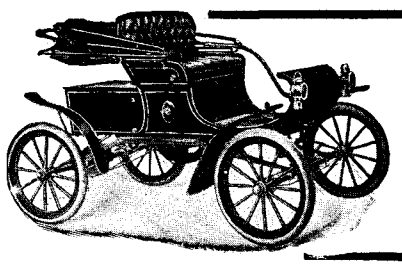

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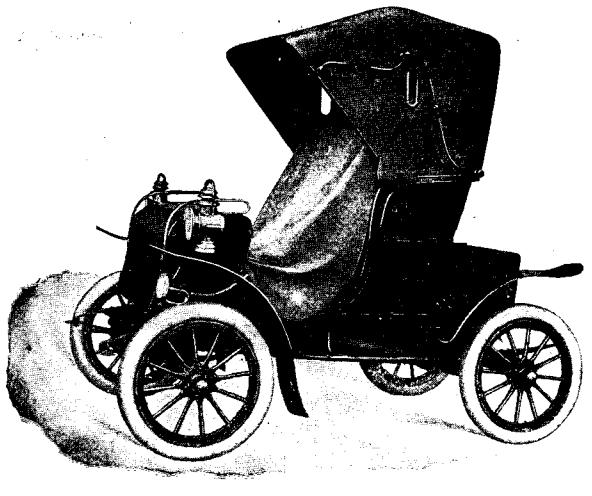

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